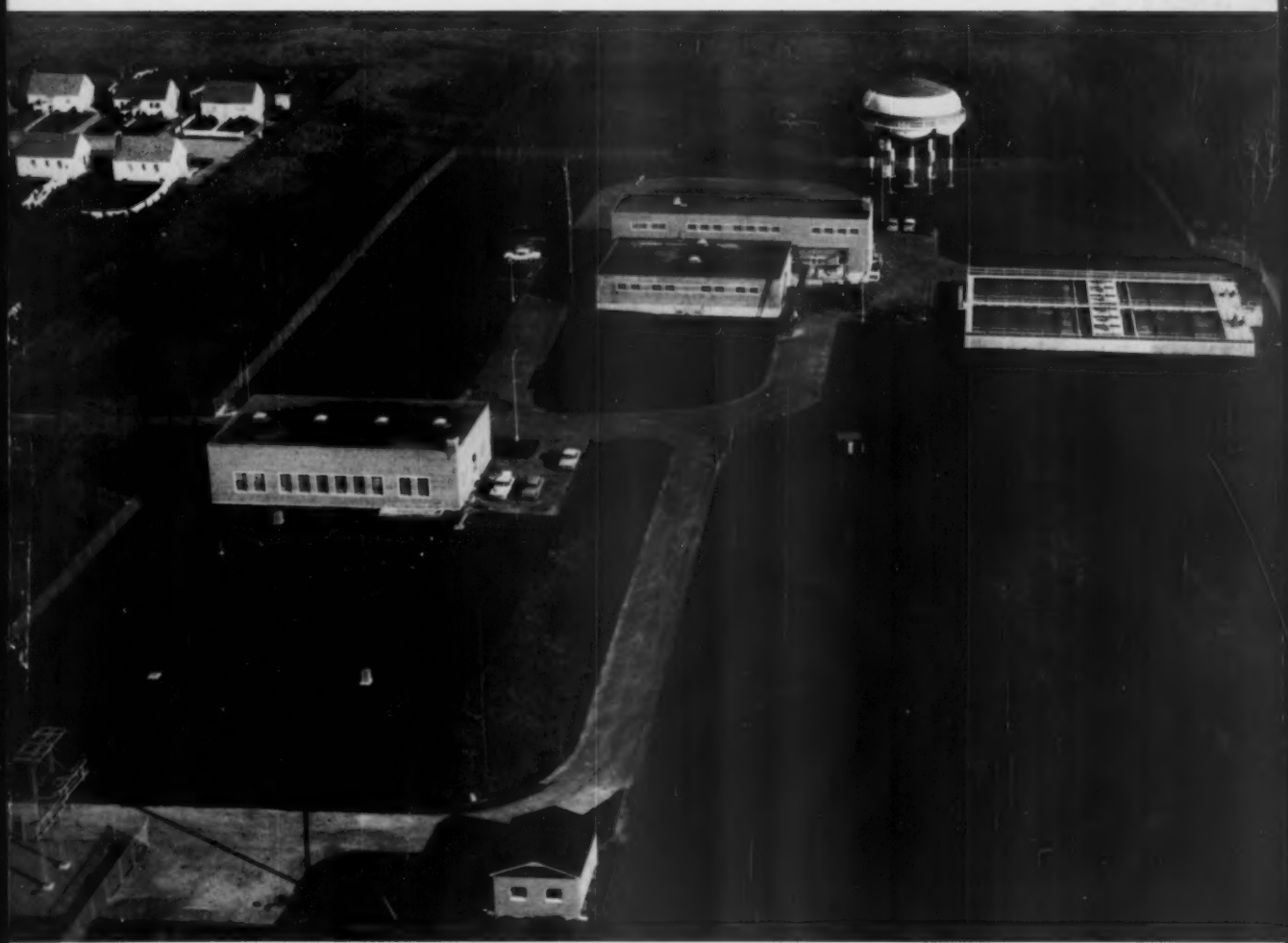
A Scranton Gillette Pu'lication

JUNE 1959

WATER & SEWAGE WORKS

WATER SUPPLY • SEWAGE DISPOSAL



▲ **NEW SUSQUEHANNA RIVER PLANT, part of the overall plan for developing a new source of supply and treatment facility to improve Lancaster, Pa.'s water service. p.p. 242**

Chlorine Feed Equipment—p. 231

AWWA Program—p. 246

Layne pumps top more producing water wells

Layne Pump Design, manufacture and installation are only part of the complete water service offered by the Layne organization. Other services include: Initial surveys, explorations, recommendations, site selection, foundation and soil sampling, well drilling, well casings and screens, gravel wall wells, construction of water systems, complete research staff and facilities, maintenance and service, chemical treatment of water wells, water treatment. *Write for Bulletin No. 100.*

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SANTA PAULA, CALIFORNIA, already a bustling center of agricultural activity, is building to share in California's phenomenal industrial growth. To accommodate new industry and meet the needs of a growing population, Santa Paula recently completed a bond-financed sewer expansion project, using Vitrified Clay Pipe exclusively. Over 6 miles of Vitrified Clay Pipe were installed.

Like Santa Paula, growing communities everywhere need the permanence and safety that only Clay Pipe can provide. Clay Pipe is the only pipe that never wears out . . . does not rust, rot, corrode, or crumble. And with its new research-developed, factory-made joints, Clay Pipe is faster and easier to install than ever before.

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CONSULTING ENGINEERS: J. M. Montgomery Engineering Co. **CONTRACTOR:** N. P. Van Valkenburgh Co.

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When you need help or information on such problems, write to our Permutit Division, Dept. WS-69, 50 West 44th Street, New York 36, N. Y. . . . or Permutit Company of Canada, Ltd., Toronto 1, Ontario.

Vol. 106 No. 6

JUNE • 1959

A Scranton Gillette Publication

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Knight on a shining white Chlorinator...

I thought my days of glory were ended!

For years I charged around the countryside purifying wells with Merlin's Magic Salts. People paid me fortunes in gold and silver. Furthermore . . . sometimes my magic *worked.*

Then, suddenly, my gravy train slowed down. Wherever I travelled, I saw slick looking boxes popping up beside sick looking wells. They were every color of the rainbow. Polluted water was fast becoming a part of the past. So was I! Then, one day, I saw a stranger in the act of installing one of these weird boxes.

I ambushed him. Asked him what he thought he was doing . . . ruining an honest Knight's work. And he had the gall to tell me that he was selling Fischer & Porter Chlorinators. CHLORINATORS! I laughed and laughed. "Don't you know that chlorine is impossible to control . . . that it eats up everything in sight?" And with that I turned back to my white charger.

WHANG! Before I could mount, he pinned me to the ground with a stock model. Then he told me all about stacked diaphragm regulators, corrosion-proof materials, even built-in flowmeters. What could I do? I did the only thing possible. *I bought one.* Traded off my trusty steed for it. Whew . . . what a salesman.

So I don't have a horse anymore. And my old business is all washed up. But I don't care. I'm doing just fine charging a nickel a glass for the purest, safest drinking water in the Belgian Congo. If you're in the market, drop by. Or, get your own *safe water by writing Fischer & Porter Company, 169 Fischer Road, Hatboro, Pa. In Canada, write Fischer & Porter (Canada) Ltd., 2700 Jane Street, Toronto, Canada.*

FP FISCHER & PORTER COMPANY *Instrumentation and Chlorination*

SEE US AT THE AWWA ANNUAL CONFERENCE—BOOTHS 155-7

Briefs

Construction of the Selset Reservoir was required to increase the water supplies of one of England's major industrial centers. The progress in developing impoundment reservoirs in two river valleys and construction methods in building this new reservoir—page 225.

Multi-Speed Pumps are becoming a necessity to enable the pumping capacity of the water works plant to keep pace with the constantly increasing rate of consumption, and where the physical facilities of the plant cannot profitably be enlarged—page 228.

Chlorine Feeding Equipment—This discussion of the fundamental principles of safe, accurate, and reliable application of chlorine to water and wastewater treatment processes, includes information on the features of a number of proprietary chlorine feed devices—page 231.

Fatty Oils absorb taste and odor contaminants from water supplies. This ability is demonstrated by a qualitative analysis involving color development on specially prepared aga plates—page 237.

Stream Flow Measurements—as used to determine quantities of water runoff is merely an academic approach. Handbook objectivity in engineering practice must give way to subjective information or to human "guesstimates". Competition among water users is difficult to assess in advance, and it is this use that will determine the total available water—page 239.

Lancaster Pa., developed a new source of supply and treatment facilities to meet increased consumption that was primarily associated with meeting industrial demands rather than increased domestic usage—page 242.

AWWA Technical Program—A listing of all technical sessions, for the 79th Annual Conference—July 12-17, to be held at San Francisco—page 246.

Antifriction Bearings is the subject of this part of the current series on the Design, Construction and Maintenance of Centrifugal Pumps—page 248.

Water Softening—This 45th part of Dr. Symons series on Water Works Practices discussion and illustrates the economic aspect of Demineralization —page 250.

Bench Scale Studies often provide data that does not agree with pilot plant or full scale results. However, bench scale experiments can yield valid design data if process variables are controlled. A bench scale unit, developed at Rice Institute, designed to control process variables is described in this article—page 254.

Air-Liquid Problems, Solids Behavior were subject featured at the New Jersey S&ISW meeting. For the highlights of seven of the papers presented see page 257.

Marine Pollution is a problem looming up in the future for a coastal communities. A report of the present state of this problem is on page 259.

Institute of Sewage Purification Conference at Southport, England had an international flavor with American and Russian participants. The meeting is reported on page 263.

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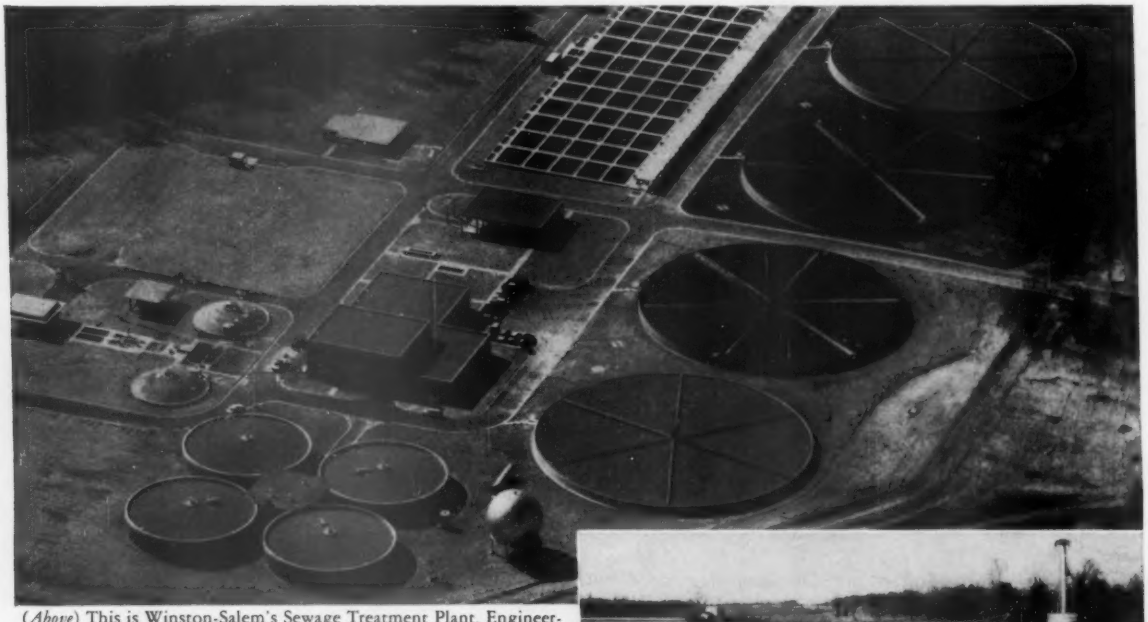
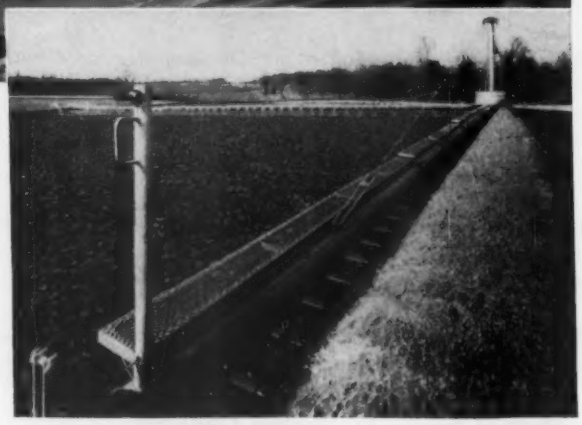
The four giant P.F.T. Rotary Distributors, 200′ in diameter, are characteristic of this tremendous growth. Equipped with specially designed P.F.T. Spreader Jets, for uniform distribution, these soundly engineered and ruggedly constructed distributors handle a flow of 25.0 mgd!

Other P.F.T. equipment in this modern sewage treatment plant, capable of handling a population equivalent of 200,000 and designed by Piatt and Davis of Durham, N.C., includes: Four 90′ Floating Covers, three complete Pearth Gas Recirculation Systems (the fourth digester is arranged for future Pearth which can be installed without interrupting digester operation), three P.F.T. #750 Heaters and Heat Exchangers that are gas and oil fired, Gas Safety Equipment, Supernatant Equipment and Floating Cover Gauge Boards with High and Low Level Alarms.

Crack engineering and construction teams, along with high quality P.F.T. sewage treatment equipment, gives progressive Winston-Salem truly a plant to be proud of.



(*Above*) This is Winston-Salem's Sewage Treatment Plant. Engineering skill and modern treatment equipment makes this plant one of the finest in the country



(*Right*) 3 tons of bronze forgings are incorporated in the four P.F.T. Rotary Distributors at Winston-Salem. The P.F.T. Spreader Jets are two-piece forged bronze units with removable deflectors.

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News—Here & There

Drinking Water Standards

The U. S. Public Health Service has under consideration, the revision of their Drinking Water Standards, In view of the changes in the nature and extent of impurities which are being added to the nation's supplies as a result of greater population growths and even greater technological and industrial development, the Public Health Service has appointed an Advisory Committee to re-evaluate these Standards, which were first formulated 45 years ago and last revised in 1946.

The original Standards, set up by the Public Health Service were written to apply only to water used on interstate carriers and this remains their only legal basis. However, State health departments, the AWWA, and the Armed Forces have accepted them as standards for public water supplies. This general acceptance, the Service feels, makes it mandatory that they be kept current and that the basic knowledge required to deal with new problems be developed before problems become acute. In considering standards for limiting impurities in drinking water at this time, special attention was given to the problems involved in setting limits for non-living contaminants such as radionuclides and synthetic organics and other chemicals.

John Krause Retires

John W. Krause, Water Superintendent of the Village of LaGrange, Illinois retired on May 1, after completing more than 20 years of service with the LaGrange Water Department.

Mr. Krause was honored, just prior to his retirement, at a dinner-meeting of the Mid-Central Water Plant Operators Association. As a special recognition, the Mid-Central Water Plant Operators Association voted unanimously to present Mr. Krause with the first annual "John W. Krause Memorial Award" as the outstanding water plant operator of the association.

Mr. Krause came to the Village of LaGrange in December, 1938 as Chief Engineer for the water plant. Prior to that, he had been for 15 years plant operator and water superintendent for the Village of Brookfield. Prior to that he had worked with the Village of Downers Grove as plant operator for the water and power plant and with the Fairbanks Morse Company in their Testing Division.

In 1939, the Village of LaGrange began softening water through the method of lime-zeolite softening. It was largely through Mr. Krause's efforts and recommendations that this process became the first successful zeolite softening facility in the United States. Mr. Krause has become a recognized authority on zeolite softening operation.

Mr. Krause came to the Village when the plant was pumping approximately 800,000 gpd from two wells and supplied about 2,500 customers. Today the plant produces 1,500,000 gpd from four wells to 4,000 customers.

Earl Devendorf Retires

The New York State Department of Health has announced the retirement of Earl Devendorf as Director of the Bureau of Environmental Sanitation.

Shortly after receiving his M.S.C.E. degree from Union College he joined the New York State Health Department as an assistant engineer. In 1933, he was designated by Governor Lehman to represent New York State municipalities in connection with the processing of applications to the federal government for financial aid in the construction of water supply systems and sewage treatment works to relieve unemployment. During the second world war he was appointed State Water Coordinator and organized, in collaboration with the State War Council, the Mutual Aid Plan for Water Services, which was later established on a permanent basis by the Legislature. Later he was nominated by Governor Dewey and appointed as an advisory member of the Technical Board of the International Joint Commission.

More recently Mr. Devendorf was awarded the John M. Diven medal of the AWWA and the George Warren Fuller Memorial. He also was awarded the Arthur S. Bedell Medal of the FSI&WA, and the Hermann M. Biggs Award of the New York State Public Health Association.

Computer Programs For Sewer Hydraulics

The City of Chicago has developed three computer programs described as unique in the field of sewer hydraulics.

Two of the Chicago developments are known as "Program for Urban Runoff Computation" and "Program for Structural Analysis and Design of a Reinforced Concrete Arch Sewer."

City of Chicago engineers are now completing work on the third program to determine optimum pumping station capacity. This problem has such a myriad of calculations that it would be impractical to attempt to solve manually.

All three programs use the G-15, a low cost, medium size, general purpose electronic digital computer made by Bendix Aviation Corp.

The "Program for Urban Runoff Computation" was prepared for the "Chicago Hydrograph Method of Sewer Design" developed by A. L. Tholin, administrative engineer, Dept. of Public Works, and Clint J. Keifer, sewer hydraulics engineer.

Mathematics involved in the comprehensive "Chicago Method" require approximately one month manually. Machine time on the computer is one hour for a 9,000 acre area.

The "Program for Structural Analysis and Design of a Reinforced Concrete Arch Sewer" reduces manual mathematics of one week to 23 minutes of machine time.

No time reduction comparison is available for the pumping station program since there is no known previous attempt by manual analysis to include all the factors involved.

The "Urban Runoff" and "Structural Analysis" programs have been published and made available to other G-15 users through the Bendix Computer Users Exchange Organization.

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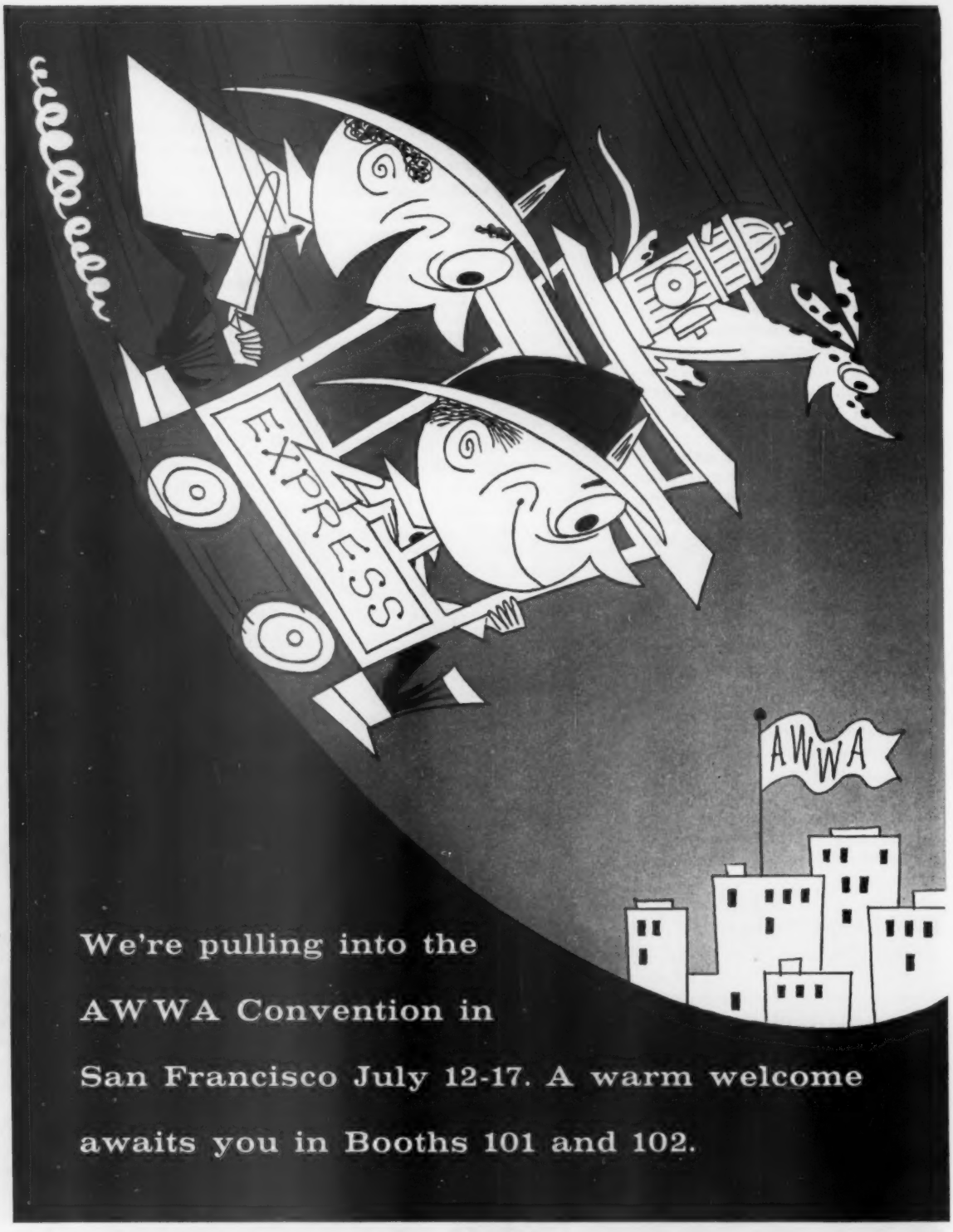

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Manufacturers of fire hydrants, gate valves, and cast-iron pipe

News—Here & There

CONTINUED FROM PAGE 7A

The pumping station program will be published and made available to other users shortly. All three represent the combined efforts of Keifer, sewer hydraulics engineer, and Aizad Kahn, a civil engineer in Chicago's Bureau of Engineering.

California May Go Into Water Business

A proposed state constitutional amendment which would permit the state of California in the water business, arm it with adequate financing and assure the sanctity of water contracts was passed by the California Assembly and sent to the State Senate.

The measure was sponsored by Assemblyman Carley V. Porter of Compton, who said it would provide a bond issue large enough to complete the Feather River project and tie the money to the project. It also would require a two-thirds vote of both legislative branches to void a contract between the state and one of its political subdivisions for water.

West Va. Passes Water Resources Bill

The legislature of West Virginia has passed a measure changing the State Water Commission to the State Water Resources Commission.

Under the law, the new agency is charged with investigating "The problems of agriculture, industry, conservation, health, stream pollution, domestic and commercial uses and allied matters as they relate to water resources of the State." In addition, it shall "formulate comprehensive plans and recommendations for the further development, improvement, protection, preservation, regulation and use of such water resources."

The Water Resources Commission will be a corporation and as such, may sue and be sued. In addition to the present members of the Commission the new agency will consist of the Director of the State Geological and Economic Survey and one other member to be appointed by the Governor. Present members of the Commission are the directors of the Health Department and Conservation Commission and three members appointed by the Governor.

The new agency is given the authority to prevent violations and threatened violations of the provisions of the law by injunction proceedings if the offender fails to comply with the terms of a cease and desist order from the Commission. The procedure for serving the cease and desist order remains unchanged from the existing law.

Dr. Lamb Joins Univ. of N.C.

The University of North Carolina has announced the appointment of Dr. James C. Lamb, III as Associate Professor of Sanitary Engineering in the Department of Sanitary Engineering of the School of Public Health at Chapel Hill, N. C.

Since 1955, Dr. Lamb has been serving as a sanitary engineer with the American Cyanamid Company, Bound Brook, N. J. He has been responsible for the technical aspects of the industrial waste program including the laboratory and pilot plant work which culminated in the complete process design, construction, and initiation of operation of a $4 500,000 waste treatment plant at Bound Brook.

Dr. Lamb received his undergraduate education in civil engineering at V.M.I. and his graduate education, leading to the Doctor of Science in sanitary engineering, at M.I.T. He has previously held teaching positions at V.M.I. and the Newark College of Engineering and has served as special lecturer and research associate in sanitary engineering at M.I.T.

An author of numerous technical papers, Dr. Lamb is a member of the ASCE, the AWWA, the FSI&WA, Sigma Xi, Chi Epsilon, and is a registered professional engineer in Virginia.

In addition to his teaching responsibilities at the University, Dr. Lamb will be in charge of research work being sponsored by the Mead Corporation on the chemistry and removal of color from pulp mill wastes.

Hawaii

A bill introduced in the Hawaii Senate would subject all water resources in the Islands to regulation by the Hawaii Water Authority.

Designed to protect and conserve water through government regulation, the measure includes provisions protecting water resources from pollution from any source. Off-shore waters are also included in the scope of the proposed legislation, which states that water for "navigational, fish and wildlife and recreational uses" would come under the protective provisions of the bill.

The water authority would be authorized to "enter upon any land to conduct investigations and studies of and to inspect water resources and their use" and to "formulate comprehensive plans for the most beneficial use of the water resources of Hawaii.

Concrete Pipe Assns. Appointments

The Concrete Pipe Associations, Inc., has announced the following promotions and appointments:

Marjorie L. Congleton, formerly Secretary to the Managing Director and Office Manager has been made Assistant to the Managing Director, Howard F. Peckworth, for all three concrete pipe associations, The American Concrete Pipe Assn., the American Concrete Pressure Pipe Assn., and the American Concrete Agricultural Pipe Assn.

John G. Hendrickson, Jr., formerly Research Engineer for the American Concrete Pipe Assn., and the American Concrete Pressure Pipe Assn., has been promoted to Director of Engineering-Research of both Associations.

Harold A. Cloud has been appointed Assistant Managing Director of the American Concrete Pressure Pipe Assn. Mr. Cloud is a graduate of the University of Minnesota, Institute of Technology and also holds a Master of Science degree from the same institution. Mr. Cloud was previously employed as a Research Engineer for the Minneapolis Honeywell Regula-

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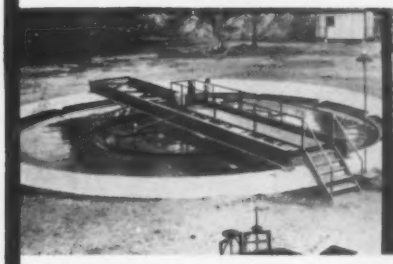
YEOMANS MANUFACTURES THE MOST COMPLETE LINE OF APPLICATION-DESIGNED SEWAGE TREATMENT EQUIPMENT

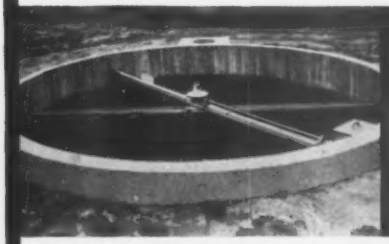
which includes..



. . SPIRAFLO CLARIFIER for both primary and final clarification of domestic and process wastes. A clarifier of radically different design, the Spiraflo offers complete settleable solids removal; greater removal of finely divided particles; positive grease, scum oil removal; uniform velocity throughout tank; and straight wall design which reduces construction costs.

. . the HI-CONE, the most important development in the surface aeration process of activated sludge treatment in the last 30 years. The Hi-Cone offers much greater circulation, and can handle substantially more sewage with no increase in power consumption per MG treated. Maintenance costs are minimized because nothing can clog.

. . the CAVITATOR, a newly developed Yeomans unit for low cost treatment of both domestic sewage and industrial wastes. Perfectly suited for small communities, subdivisions, motels, resorts, schools and industrial plants, the Cavitator has excellent purification efficiency, extremely high oxygen transfer efficiency, and extremely low air requirements per pound of B.O.D. removed.



. . the WATER-WHEEL, a rotary distributor used with trickling filter systems in the secondary treatment of sewage. An exceptionally rugged, yet simple piece of equipment, the Water-wheel provides uniform distribution over the entire filter bed at all flow rates . . even the lowest. Costly accessories, such as underground feed pipe, dosing chamber with siphon, center support, and mercury seal, are not required.

. . YEOMANS ROTARY DISTRIBUTORS (both standard rate and high capacity). Standard rate units distribute evenly across the entire filter bed . . adjustable nozzles produce fine, well-aerated spray which carries down high volumes of oxygen. For high capacity filters, both the Yeomans high capacity type distributor and the Aero-Filter system are available.

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T-5917

News—Here & There

CONTINUED FROM PAGE 9A

tor Co., for three years. For six years previous to this he was a member of the University of Minnesota Agricultural Engineering Staff.

Wisconsin Sewage Works Elects Officers

The Conference of Wisconsin Sewage Works Operators at their annual business meeting elected Mr. Arnold Sorensen of Neenah, Wis., as president.

The meeting was held in conjunction with the 16th Wisconsin Sewage Works Operators Short Course which is sponsored by the League of Wisconsin Municipalities and the Conference of Wisconsin Sewage Works Operators, with the Wisconsin State Laboratory of Hygiene, the University of Wisconsin, and the Wisconsin State Board of Health cooperating in the presentation of the course material.

Other officers elected at the conference for the 1959-1960 term are: Roger P. Scovill, Madison, Vice President; C. W. Bogenhagen, Fond du Lac, Secretary Treasurer; and Vern Zingsheim, South Milwaukee, Lloyd Owens, Eau Claire, and Lyle Landvatter of West Bend as Directors.

New Water Rights Proposals

New measures have been introduced in the Senate and in the House aimed to safeguard State water rights and to subject Federal agencies to State water laws.

The measures, introduced mostly by western Senators and Representatives are clearly written and their intent is clear. The first section provides that "the authority of all States relating to the control, appropriation, use or distribution of water within their boundaries, including water on the public lands of the United States, is hereby acknowledged; and it is the policy of the Congress that such authority of the States shall be given full recognition by the Federal Government in connection with Federal Programs, projects or activities for the conservation, development and use of the Nation's land and water resources."

Representative Walter Rogers of Texas is the author of the first of several identical bills introduced in the House. Other sponsors in the House include Representatives David King and Henry Dixon of Utah, George Grand of Alabama and Thomas G. Morris of New Mexico.

In the Senate, Senator Frank E. Moss of Utah submitted a measure known as A 1416. This measure was co-sponsored by Senators Wallace Bennett of Utah, Francis Case and Karl Mundt of South Dakota.

Santa Ynez To Get Water Loan

The Department of the Interior has approved the $3,800,000 application for a loan to the Santa Ynez River Water Conservation District, Santa Barbara County, California. Repayment of the loan is 40 years.

The application and report, has been transmitted to Congress where it must remain in committee for a mandatory 60 days before funds can be appropriated.

Proceeds from the loan will be used to construct a water transmission main from the Cachuma Dam in Santa Barbara County to the Santa Ynez area, and a distribution system in the Santa Ynez-Ballard-Solvang area. The water main footage will be approximately 170,000 in diameters from 6 to 30 in.

Texas Short School

The forty-first annual Short School of the Texas Water and Sewage Works Assn. was attended by 812 registrants, not including numerous guests and ladies.

The Short School is sponsored annually by the Texas Water and Sewage Works Association in cooperation with the Texas State Department of Health; Southwest Section, AWWA; FSI&WA; Texas Engineering Extension Service; and Texas A.&M. College.

This year Sewage and Industrial Wastes Sessions were held Monday through Wednesday, with the Water Works Sessions beginning on Wednesday morning and continuing through Friday. Papers were also presented for the information of other groups in attendance including the bottled water industry, industrial groups, and swimming pool operators.

At the annual business meeting, held on Tuesday, the following officers were elected to serve for 1959-1960: President, J. L. Swanson, Port Arthur; President-Elect, Henry J. Harvill, San Benito; Vice Presidents: W. H. Measures, Midland; Edith Young, Highlands; Delbert E. Spivey, Jacksonville; and Walter Biederman, Waco. The new officers then re-elected the current appointed officers of the Association.

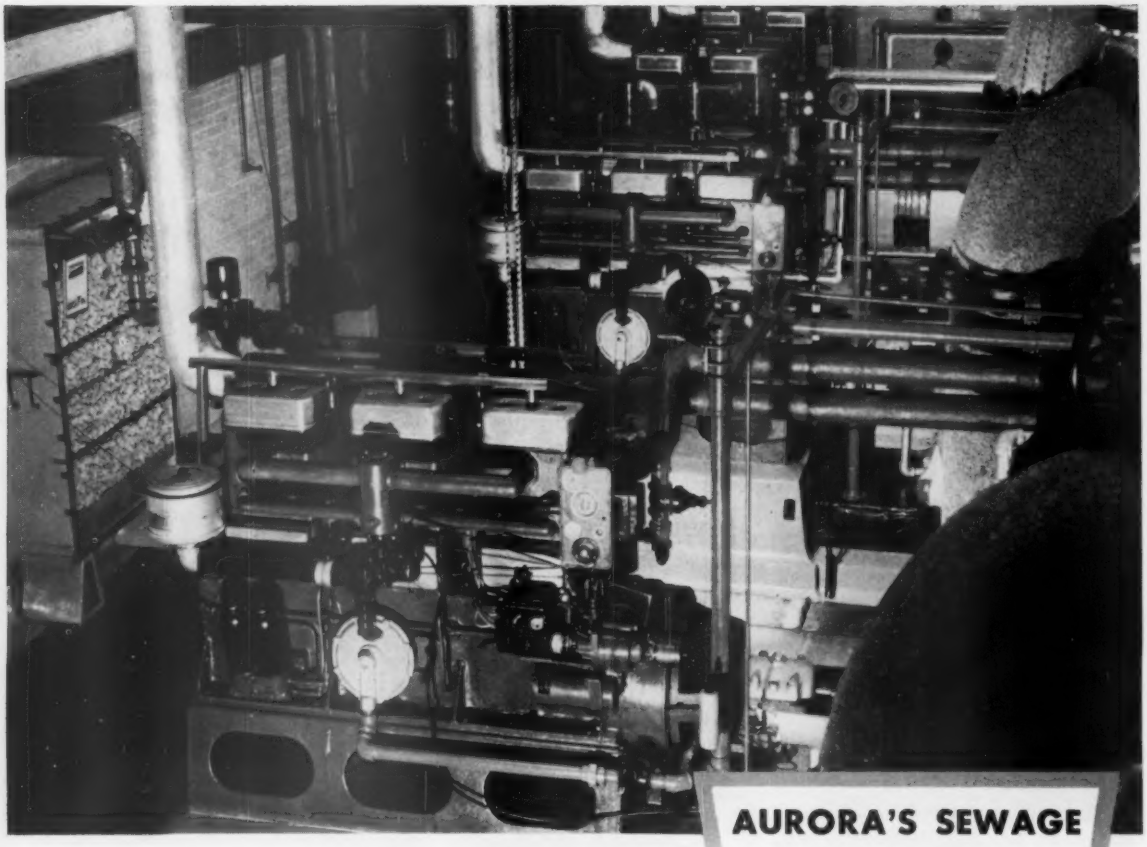
Water Treatment In Russia

Reprints of a technical paper by V. J. Calise and W. A. Homer, Graver Water Conditioning Co., N. Y., presenting the sum of over 150 technical articles from Soviet Russia and its satellites is available.

The paper, a survey of water treatment practices in Russia and Eastern Europe, shows that many of the processes used by the Russians are hangovers from the 1930-40 era, and that the adoption of newer techniques is hampered by expense.

A comparison of water treatment costs for a utility shows that every item except labor is substantially higher in the Soviet Union. Even with this difference in labor costs, Russia still pays $2.56 for the treatment of every 1000 gallons of water while a comparable U. S. facility pays 90 cents.

The authors found that such common U. S. water treatment techniques as demineralization and lime-softening were rarely used in the U.S.S.R. because of their expense. However, they cite a Soviet engineer who stated in 1957 that demineralization materials would be much more plentiful beginning with the following year. The authors also found that Russian equipment for reducing the oxygen content of water was crude in design and operation.



for over 22 years

AURORA'S SEWAGE TREATMENT PLANT has been POWERED by these

CLIMAX ENGINES

The Aurora Sanitary District, Aurora, Ill., installed two 75 hp, six-cylinder Climax pump engines in 1936. These direct-connected engines performed so well—always starting under load—that, in 1940 two 50 hp Climax engines in generator sets were added. All four engines had sewage gas and gasoline carburetors. In 1953, gasoline was replaced by natural gas as standby fuel. This gave the plant four-way safety—duplicate engines . . . two fuels . . . two ways to start generator engines . . . freedom from electric storm interruption. After 22 years, 8 months, pump engines had paid for themselves 4.78 times; generator engines 2.5 times after 17 years. Year after year Climax engines keep on making records like this. 40 to 610 hp; V-type—four models, 8 and 12 cylinder; in-line type—four models, 4 and 6 cylinder. Capable of operation on sewage gas, natural gas, butane, gasoline, or any combination. Send for complete power chart and bulletins.

CLIMAX ENGINE MANUFACTURING CO.
DIVISION OF WAUKESHA MOTOR COMPANY
FACTORY AT CLINTON, IOWA

CL-104

Equipment News

New Trickling Filter Design

601

August F. Vorndran, Jr., Webster, New York, has designed a trickling filter that is said to feature much higher efficiency at one-third or less cost, in one-third less space, that is adaptable to new or existing plants, including activated sludge, conventional, filter-lagoon, etc.

The new design features a floor built from a grid of precast concrete beams, and gratings that provide more air space and less beams. The beams are provided with lug spacers to admit the maximum amount of air and yet retain the coarse filter media. With the underside open to ventilation close to the maximum possible aeration is provided.

Versatile Hydraulic Crane

602

Teale & Company, Omaha, Nebraska, has developed a versatile, fully-hydraulic crane, that offers a wide range of applications for municipalities concerned with economy.

The Versa-Lift truck-mounted crane can quickly solve the problems of several departments. Since the

crane mounts in only 22½ in. of space, it leaves the truck platform relatively free for near-capacity loads.

The crane lifts 7,000 lbs at 8-ft, 3,500 lbs at 16-ft, and works in a full 360-degree circle. It will place loads 30 ft up, 16 ft below the ground, and reach out from 16 to 22 ft. Hydraulic outriggers give even maximum loads absolute stability in any position. Smooth hydraulic power assures positive load control and movement.

The Versa-Lift is also available with remote controls, and many other work attachments permit it to be used for digging, dragging or handling pipe, posts and poles.

New Baffles Cut Backwash Time

603

Filtration Equipment Corp., Rochester, N. Y., has developed the Feco Lightning Surface Wash Baffles for rapid sand filters. According to the company, this new development makes possible the production of clean filter beds in half of the normal backwash time.

These new type surface wash baffles were designed to prevent the uneven distribution of backwash water thru the sand: alleviate the normal

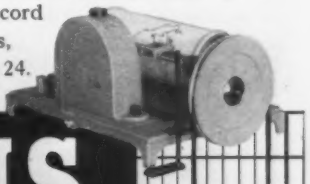
CONTINUED ON PAGE 15A

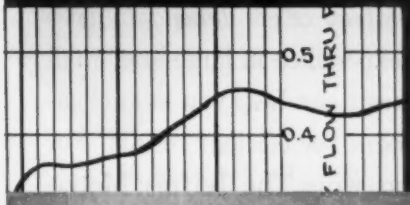
NOW

LOW-COST AUTOMATIC FLOW RECORDING

Directly Readable Flow Charts

Obtain graphic records of liquid flow directly readable in million gallons per day or gallons per minute over various sizes of Parshall flumes. The same recorder can also be used with charts reading in feet and hundredths to record head or surface fluctuations in lakes, streams, wells. Write for free Bulletin 24.





STEVENS

TYPE F RECORDER

...For Measuring Sewage, Industrial Waste and Other Flows

The planning and efficient operation of any project which involves measurements of flowing liquids is based on flow data which can be obtained with STEVENS Recorders. These instruments are at work compiling data on hydroelectric and flood control projects and in water works, sewage disposal plants, irrigation and industrial installations in all parts of the world.

Experienced technical staff available to supply product information for liquid measurement installations. Write, giving description of project and scope of data desired.

HYDROGRAPHIC DATA BOOK

Invaluable for your reference file

124 pages of technical data on recorder installations, plus a wealth of hydraulic tables and conversion tables. $1 copy. (No COD's.)

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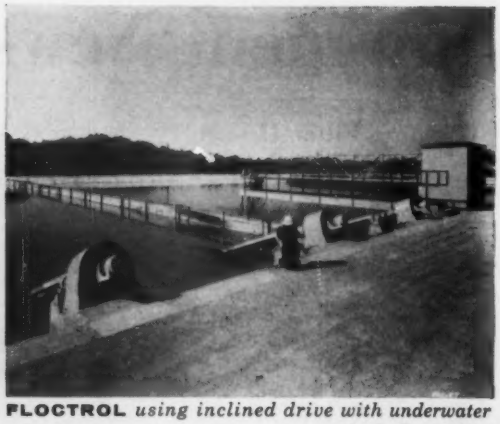
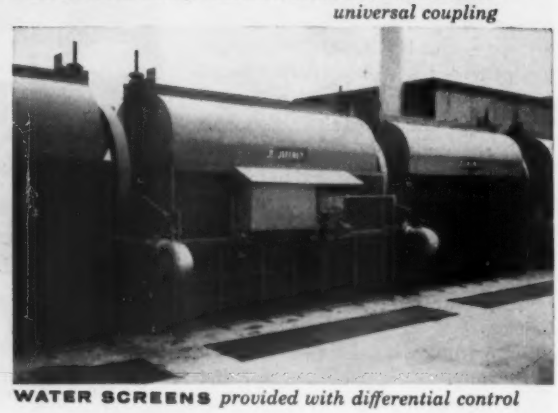
specialists in hydrologic instruments for over half a century

FLOCTROLS AND SLUDGE COLLECTORS *in slow mixing and settling basins*



FLOCTROL *using inclined drive with underwater universal coupling*

CONVEYORS *for lime and soda ash*



WATER SCREENS *provided with differential control*

Specify dependability with **JEFFREY** equipment

DIFFERENTIAL CONTROL *with visual "loss-of-head" gage for automatic water screen operation*

SHOWN here are some of the many types of equipment produced by Jeffrey for water treatment plants. Jeffrey offers *dependability* — proved by years of experience in large and small plants. Jeffrey engineers can help you in application of this equipment for efficient results. For complete information, write The Jeffrey Manufacturing Company, 996 North Fourth Street, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT... TRANSMISSION MACHINERY... CONTRACT MANUFACTURING

Equipment News

CONTINUED FROM PAGE 13A

reduction in velocity of the backwash water after it leaves the sand; and eliminate the short circuiting of the dirt-laden water between the wash troughs.

The baffles consist of boatlike units which rest on the edges of adjacent wash troughs and may be easily installed or removed from the filter to inspect the sand bed. They are made from asbestos cement sheets in units approximately four feet long.

According to information from the company, the baffles operate automatically and require no attention except to wash off the accumulated dirt on the covers with a hose at regular intervals. The baffles are unconditionally guaranteed if properly selected and installed.

Hydraulic Pipe Cutter

604

Spring Load Manufacturing Corp., Seattle, Wash., has introduced a compact new pipe cutter employing hydraulic pressure.

The new cutter requires no turning, minimum handle travel, no vise,

no muscular leverage, and will cut in any position, and works as well in cramped working space as on the shop floor. The operator simply wraps the cutter chain around the pipe and pumps. Within seconds it snaps the heaviest 6 in cast iron soil pipe in two, leaving a straight, clean edge.

The Model H works equally well on cast iron soil and Duriron pipe, and clay and concrete tile, from 2 to 6 in. It adjusts like a pipe wrench. With an extension chain it cuts clay and concrete tile up to 12 in.

CONTINUED ON PAGE 17A

Fast new 350 BANTAMS

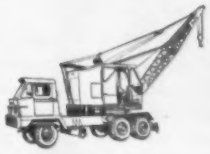
. . . with hydraulic bucket action speed up your digging and profits!

Here's America's newest trenching advancement that's letter-perfect for water and sewer contractors—new BANTAM Series 350 with optional hydraulically actuated back hoe bucket. This combination gives you tremendous new speed and digging advantages in your work—enabling you to bid lower and get more jobs . . . make more money from every job.

The hydraulically actuated BANTAM back hoe is a feature easily added to any BANTAM 350 with standard or long-boom back hoe models. The carrier mounted T-350 digs to 17'7", the crawler model to 18'10". Simply operated, it gives giant breakout action (20,000 lbs.) at the bucket teeth to speed you through tough, rocky and frozen digging conditions—provides precision ditching with intricate control for stepped-up operations in all line and intersection work. In addition, you get all the benefits of America's newest shovel-crane design: more rapid work cycles with increased line pulls . . . famed BANTAM sure-footed stability with high flotation in both carrier and crawler models . . . greater work capacity . . . simpler, completely foolproof mechanical controls.

With the T-350 BANTAM you have your choice of four BANTAM-built carriers for exactly what your price and work call for . . . the choice of standard or long side frames in the crawler model C-350. Two-speed, independent travel and in-cab digging lock are standard on the BANTAM crawler.

Try a new BANTAM . . . see how you can get your work speed and profits up to all-time highs. Call your BANTAM distributor or mail coupon.



BANTAM T-350
11-ton capacity

BANTAM CR-350
self-propelled
11-ton capacity

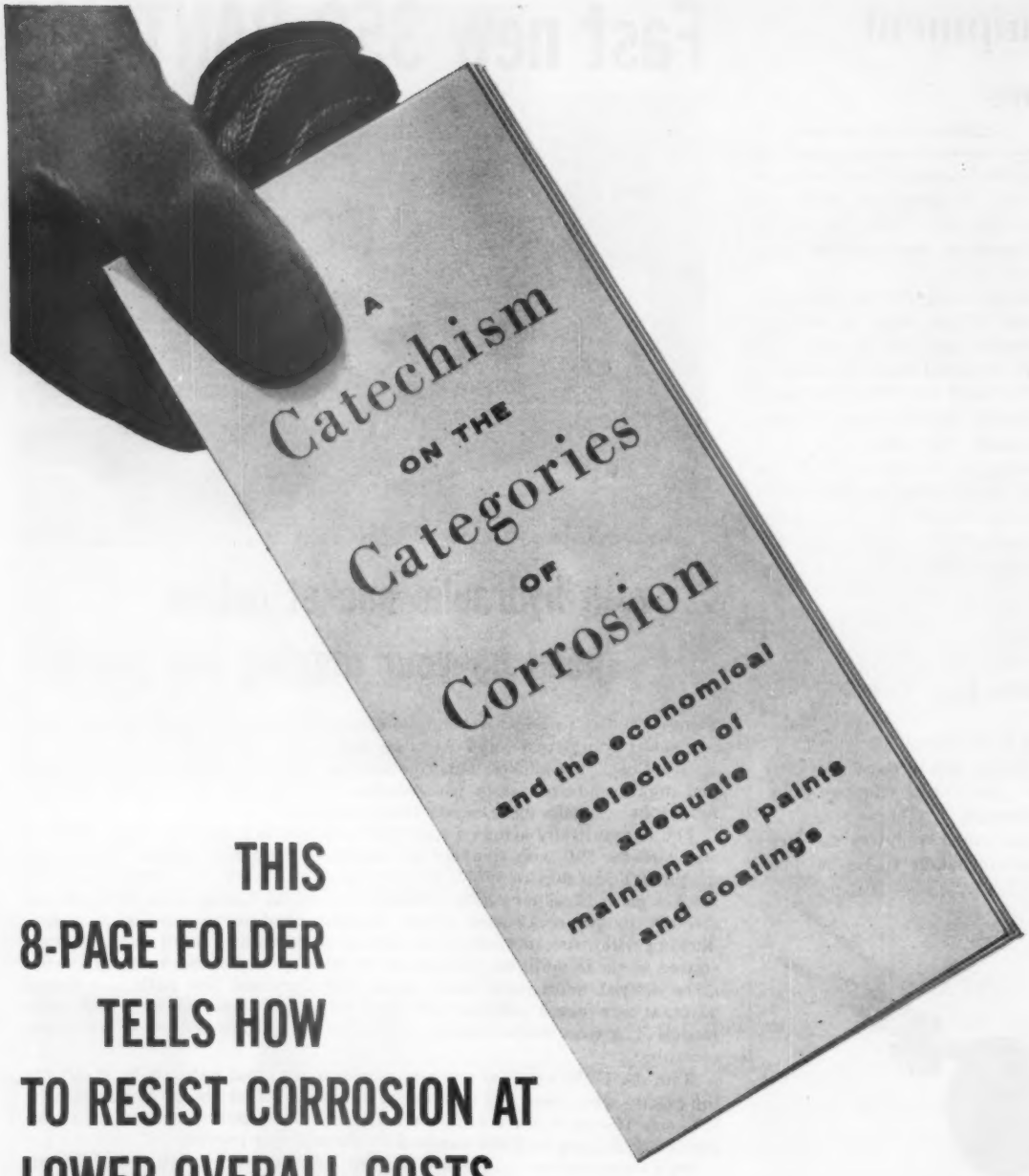
World's largest producer of truck crane-excavators

SCHIELD Bantam Co.

Schield Bantam Co. WS-238
303 Park Street, Waverly, Iowa

Please send me information on BANTAM ☐ C-350 crawler, ☐ T-350 carrier models. ☐ Include information on new hydraulically actuated back hoe. ☐ Also details on BANTAM self-propelled CR-350.

Name_____
Title_____
Company_____
Address_____
City_____ Zone_____ State_____



THIS 8-PAGE FOLDER TELLS HOW TO RESIST CORROSION AT LOWER OVERALL COSTS

If you have anything to do with maintenance of equipment or structure, or with the costs that result therefrom, this folder may be extremely useful to you. It gives a rational basis for paint and painting specifications, and tells how all surface and area exposures can be classified into the Four Categories of Corrosion.

As in all other phases of engineering, both underdesign and overdesign of maintenance painting carry economic penalties. Either one will show up sooner or later on the overall cost sheets. Although Hercules does not make any finished paints or coatings, we have had over twenty-five years' practical experience with Parlon® chlorinated rubber, a key material for corrosion-resistant and high-performance maintenance paints.

This booklet has been written with this background of experience. Write for your copy.

Cellulose Products Department

HERCULES POWDER COMPANY

INCORPORATED

900 Market Street, Wilmington 99, Delaware

CR 59-5

Equipment News

CONTINUED FROM PAGE 15A

Larger Capacity Sealed Register Water Meter

605

Rockwell Manufacturing Co., Pittsburgh, Pa., has announced a ¾-in magnetic drive Sealed Register Water Meter, with a capacity of 30 gpm. Previously only ⅝ in. models with a capacity of 20 gpm were available.

Sealed Register Water Meters provides special features such as: a hermetically sealed register to end the problem of dirt, water and condensation that fogs dials; a powerful magnetic drive which eliminates the need for a stuffing box, an exposed intermediate train and a driving dog, and, the proven oscillating piston principle for long life and accurate measurement.

Excavator-Crane

606

Davis Engineering, Inc., Dowagiac, Michigan, has developed a budget priced excavator-crane that has full hydraulic operation. All functions are hydraulically controlled from one operator station on the new Model AH-

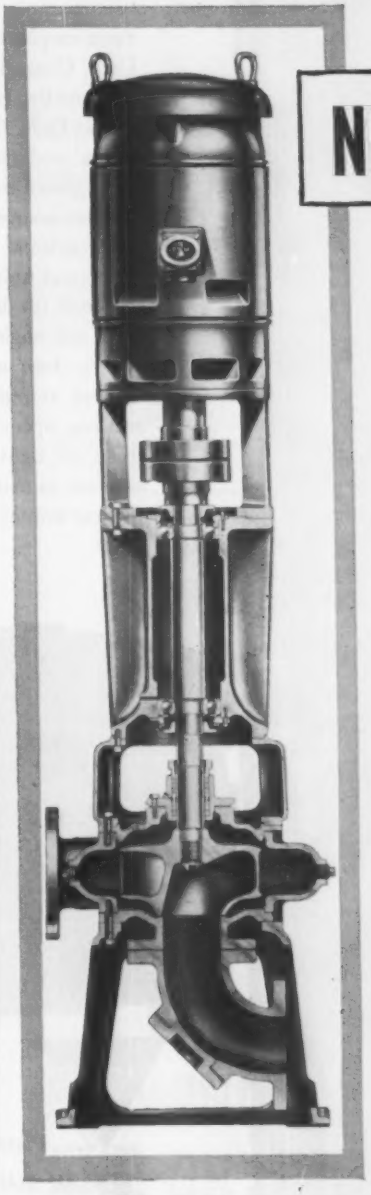
4, one-man self-propelled Hydra X-Cavator-Crane. Unlimited full swing of the upper mechanism combined with smooth sensitive, conveniently located controls, contribute to faster work cycles, and eliminates the time-consuming change of operator position when moving machine on the job.

Low cost end attachments are quickly interchangeable on the same basic boom and dipper stick and include, backhoe, shovel, clamshell and shovel-loader buckets, and backfill blade. Bucket capacities ⅜ cu yd. Backhoe digging depth 11 ft and with

CONTINUED ON PAGE 19A

For higher pumping efficiency

of solids in suspension!



NEW

Fairbanks-Morse

5440A Non-Clog Pumps

Ideal for pumping unscreened liquids with large solids in suspension

- industrial wastes
- sanitary sewage disposal
- industrial processes

Here is your answer to higher efficiencies wherever you are pumping solids in suspension!

All-new Fairbanks-Morse 5440A Non-Clog Pumps feature quick, easy convertibility between any of the many vertical and horizontal types. Power requirements of the pump are always perfectly matched to the electrical and mechanical components. Precision-machined centering fits assure accurate alignment. Exclusive F-M bladeless impeller design minimizes maintenance by preventing clogging from solids and stringy material. The 5440A is only one of many F-M solids-handling pumps designed to meet a broad range of requirements. For information, write Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.

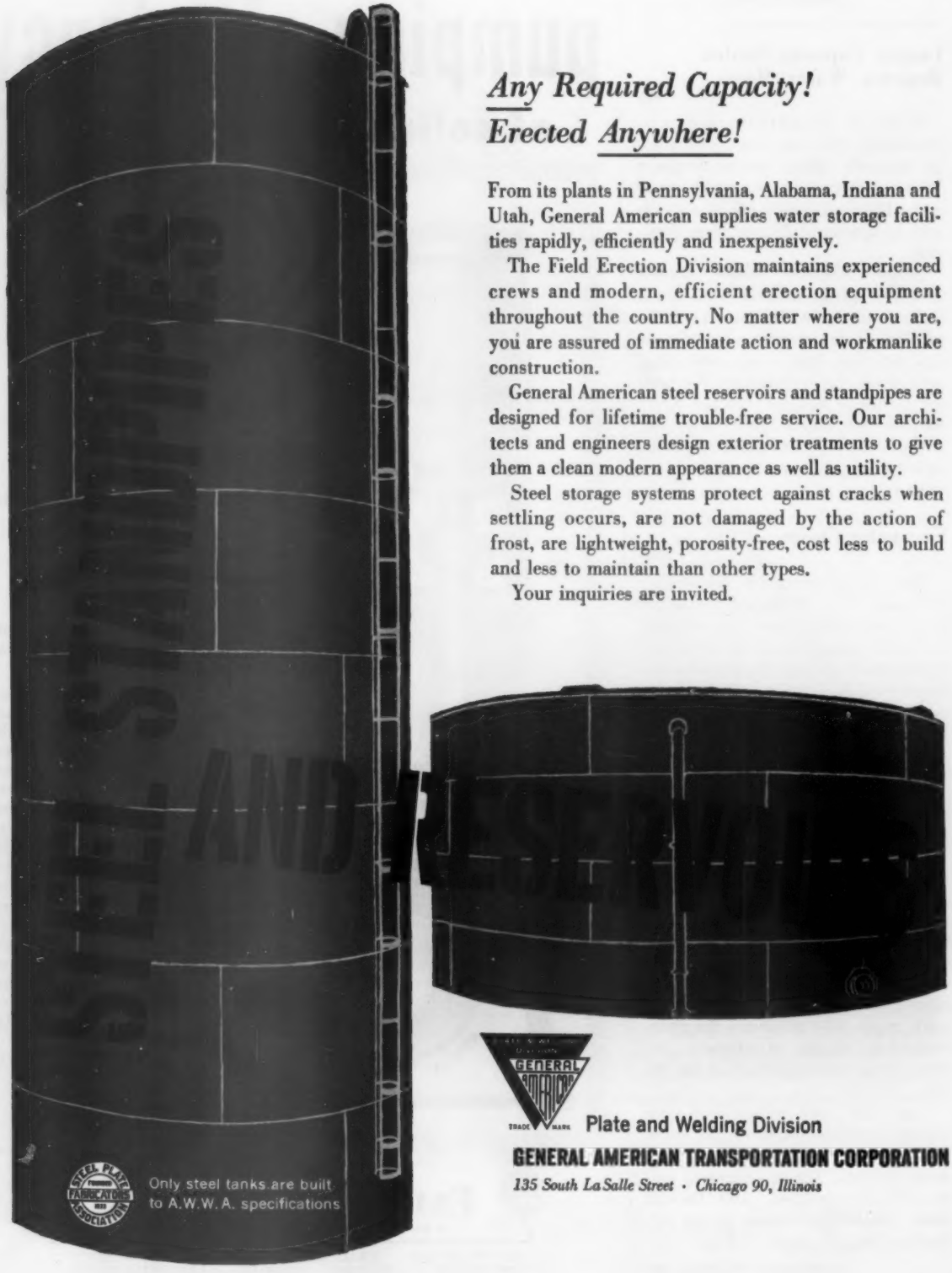
Ask for new 5440A BULLETIN!

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

ELECTRIC MOTORS • DIESEL, DUAL FUEL AND GAS ENGINES • PUMPS
COMPRESSORS • GENERATORS • MAGNETOS • HOME WATER SYSTEMS

It pays to plan with General American



Any Required Capacity! Erected Anywhere!

From its plants in Pennsylvania, Alabama, Indiana and Utah, General American supplies water storage facilities rapidly, efficiently and inexpensively.

The Field Erection Division maintains experienced crews and modern, efficient erection equipment throughout the country. No matter where you are, you are assured of immediate action and workmanlike construction.

General American steel reservoirs and standpipes are designed for lifetime trouble-free service. Our architects and engineers design exterior treatments to give them a clean modern appearance as well as utility.

Steel storage systems protect against cracks when settling occurs, are not damaged by the action of frost, are lightweight, porosity-free, cost less to build and less to maintain than other types.

Your inquiries are invited.

Plate and Welding Division

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street · Chicago 90, Illinois

Equipment News

CONTINUED FROM PAGE 17A

extended dipper stick 13 ft. High loading out position of backhoe bucket plus long reach and full swing permit easy disposal of spoil.

As a crane, the Model AH-4 can lift up to 4-ton with outriggers. A telscoping crane boom or gooseneck boom can be furnished with lifting heights up to 25 ft.

Sump Pump Motor Package

607

General Electric, Schenectady, N. Y., has introduced a new, complete sump pump motor package with a factory installed switch, cord and plug set.

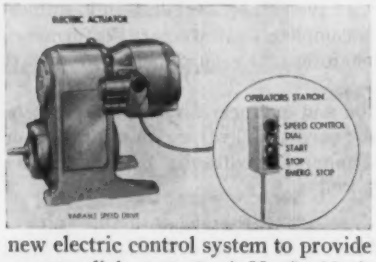
Incorporated in a single package with the motor are a new compact float or weight-type switch and an 8 ft, 2 or 3-conductor cord set. The sump pump motor is a 1½ in. inside diameter mounted, extended-hub design.

The new design requires no relubrication for sump pump operation. It features a corrosion-resistant shaft and an integrated insulation system of Mylar polyester film, Formex wire, and a protective stator bonding treatment.

Dial Speed Control for Speed Drive

608

U. S. Electrical Motors Inc., Los Angeles, Calif., has available a



new electric control system to provide remote dial control of U. S. Varidrive variable speed motors. Designated the Varitrol-electric type, this control may be located any distance from Varidrive motor. It will also permit the operator to pre-set the speed of the drive before starting.

CONTINUED ON PAGE 21A

Engineering PLUS...

Keeps Tank Interiors Corrosion Free at a Practical Cost

One of the five municipal tanks serving the City of Jacksonville, Fla. which has been cathodically protected by E.R.P. system since 1942.

The City of Jacksonville, Fla. has relied on engineering plus from Electro Rust-Proofing Corp. since 1942 to protect water storage tanks serving the city. Since installation of cathodic protection, tanks have been virtually corrosion free on the under water surfaces and maintenance costs have been reduced to a minimum.

E.R.P. engineering plus means cathodic protection systems
designed to meet your needs...
maintained to your benefit...
priced to your profit...

E.R.P. provides engineering plus to meet any corrosion problem of submerged or buried metals. For full information on cathodic protection for your water storage tanks, water treatment structures and pipelines, write for bulletin E-42.94.

ELECTRO RUST-PROOFING CORP.
A SUBSIDIARY OF WALLACE & TIERNAN INC.
30 MAIN STREET, BELLEVILLE 9, NEW JERSEY
CABLE: ELECTRO, NEWARK, N. J.

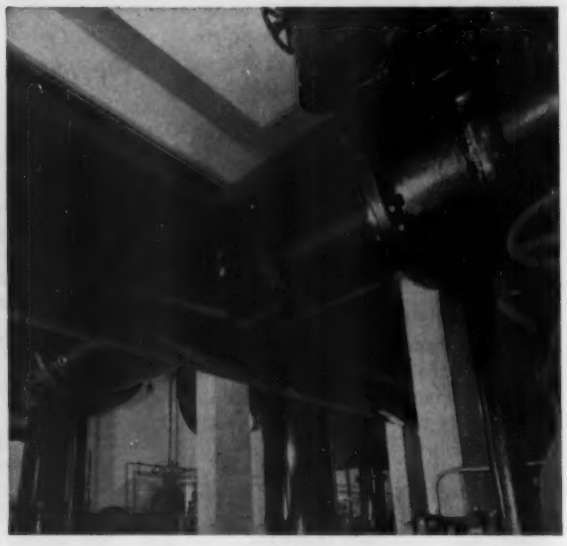
IF IT'S **FREE FLOWING AND DRY** we have accurate reliable means of feeding it. For information about these dry chemical feeders *both gravimetric and volumetric...*

Write Dept. M-42.94

WALLACE & TIERNAN INCORPORATED
25 MAIN STREET, BELLEVILLE 9, NEW JERSEY

Philadelphia's New Torresdale Plant Installs 191

ALLIS-CHALMERS VALVES



At the new 423 MGD Torresdale Pre-Treatment and Rapid Sand Filter Plant, 191 Allis-Chalmers rubber-seated butterfly valves, in sizes from 20 inches to 96 inches, are being installed. Morris Knowles Inc. of Pittsburgh was the Consulting Engineer for the Engineering Bureau of the Philadelphia Water Department on this new, modern water purification plant. When it goes into operation, it will increase both the quality and quantity of water for approximately 62% of Philadelphia's users.

Photos above show a section of the 94 separate filters and the massive filter pipe galleries where the A-C rubber-seated butterfly valves are installed. Compact and easy to operate, these valves have gained a reputation in numerous installations for completely satisfactory performance with only nominal maintenance requirements.

Product information and engineering assistance can be obtained from your nearest A-C valve representative, or by writing Allis-Chalmers, Hydraulic Division, Valve Department, York, Penna.

Hydraulic Division — RESEARCH · DESIGN · HYDRODYNAMICS · ENGINEERING · FABRICATION

Rotovalves • Ball Valves • Butterfly Valves • Free-Discharge Valves

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See us at the AWWA Exhibit, San Francisco July 12-17. Booths 67 to 69, 78 to 80

ALLIS-CHALMERS

Equipment News

CONTINUED FROM PAGE 19A

Under normal stop conditions, electric Varitrol automatically returns the drive to low speed. This protects the driven equipment from high speed starts. As a safety precaution, an emergency stop button is provided which will eliminate the return to slow speed.

Varitrol-electric type consists of: An operator's station with graduated speed control dial and start, stop and emergency stop pushbuttons; A control unit which houses the control components required; and the electric actuator motor and shifting mechanism which physically cause the Varidrive to change speed. As no mechanically relays or other devices of limited durability are used, the system offers maintenance-free operation.

Pipe Repair Clamp

609

Dresser Manufacturing Div., Dresser Industries, Inc., Bradford, Pa., has introduced a low-cost band-type repair clamp for quickly repairing leaks or breaks in steel piping.

According to the company, installation is fast, easy and foolproof. Simply snap clamp around pipe, drop bolt head through open-slotted lug and tighten nut. Compression of large size gasket seals leak completely and permanently. No loose parts to lose or to slow installation.

The new clamp is available for pipe sizes ½ through 8 in, in 3, 6, 9, and 12 in lengths.

Deepwell Turbine Pump

610

Byron Jackson Pumps, Inc., Los Angeles, Calif., has developed a Type G, deepwell pump that is designed for primary water supply users.

According to the company, the new pump, available in both oil-lubricated and water-lubricated models, handles more water with increased efficiency at lower operating costs.

One of the major design improvements in the oil-lubricated series is a new, extra-long, one-piece throttle bushing that serves both as a bearing

CONTINUED ON PAGE 23A

J-30 with hydraulic V conveyor boosts trench production 200%

This Cleveland J-30, digging heavily gravelled frost to 30" depth, helped Industrial Maintenance Co. of Lansing *triple* daily trench production for conduit installation at Battle Creek, Mich. The job was well pointed because of a 3½' water table.

The J-30's V conveyor—hydraulically shifted, controlled at operator's seat—discharged spoil to far side of the well point system (above) or to near side (right) without interrupting digging or crawler's forward movement. Dual independent hydraulic drives gave operator fingertip control of conveyor speeds and discharge direction.

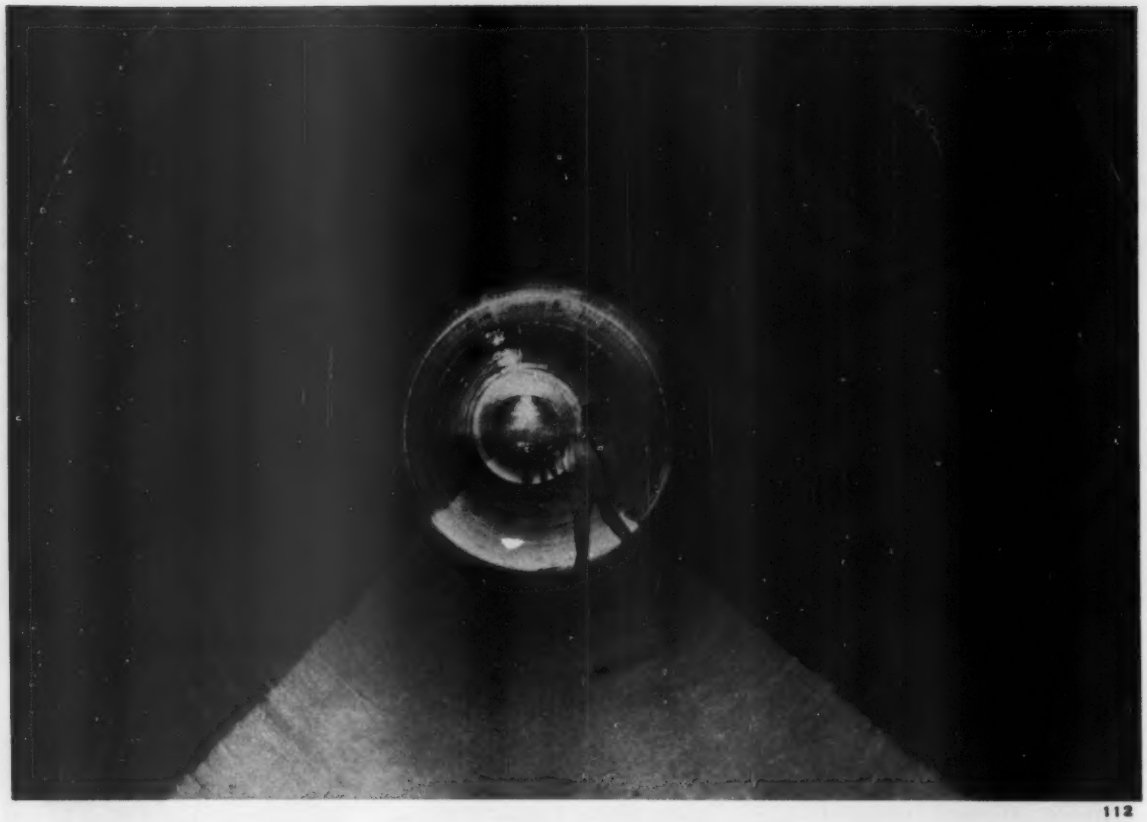
The J-30's long-lived, 1,000-hour-lubricated track has double-flanged sprockets, rollers and wheels, drives on each end of 1½" hardened pins. Operators particularly like the trencher's balance on its long crawlers, and its easy steering and maneuverability with big 16"x 3" hydraulic brakes. Digging range is 13" to 24" wide, down to 5½' deep.

Get Bulletin L-104 on Cleveland "J" trenchers from your distributor or write:

The CLEVELAND TRENCHER Co.

20100 ST. CLAIR AVE. • CLEVELAND 17, OHIO

Good Everywhere ®



112

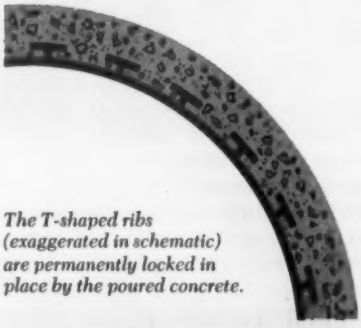
This Sewer will go a Long Way

Not only will this 9¼-foot outfall sewer extend eight miles, but it will go a long way in years of trouble-free service. The engineers who designed it say that it will still be functioning perfectly in the year 2000.

Their confidence is based on wise choice of construction materials. Every joint of pipe, every foot of monolithic tunnel, every structure is built of reinforced concrete to obtain structural strength at low cost. Every surface above the low flow line is completely covered by a continuous membrane of T-Lock Amer-Plate®, the vinyl lining that is impervious to the corrosive action of oxidized hydrogen sulfide *at any level of concentration*.

The engineers know that no one can accurately predict future rates of H_2S gas generation, so they have insured the ultimate life of the concrete by investing an extra 8 to 10% for T-Lock protection. They predict that this "extra" will spare their city the cost of a replacement sewer in about 20 years, and *save the taxpayers millions of dollars!*

Because of obvious and substantial savings such as this, millions of square feet of T-Lock are now in use in progressive municipalities from coast to coast. These include Los Angeles; Topeka; Wichita; Sioux Falls; Shreveport; Washington, D.C.; San Diego; Mansfield, Ohio; Huntington, W.Va.; Hutchinson, Kan.; and Orange County, Calif. T-Lock Amer-Plate is also on current specifications for many other municipalities. For complete list of users and specifiers, plus technical data and a typical specification, write:



The T-shaped ribs (exaggerated in schematic) are permanently locked in place by the poured concrete.

There is no limitation on size or shape of structures which may be protected with T-Lock Amer-Plate.

Amercoat® CORPORATION

Dept. WF

4809 Firestone Blvd.

South Gate, California

Evanston, Ill. • Kenilworth, N. J. • Jacksonville, Fla. • Houston, Texas

Equipment News

CONTINUED FROM PAGE 21A

and as a by-pass seal. Extending from the top case down into the first series case, the "Aqua-Flo" bushing eliminates troublesome top-case packing and prevents sand and other foreign materials from entering the bearing surfaces. Perforations leading into the by-pass ports protect against any inner column pressure build-up. The bushing does not require any lubrication.

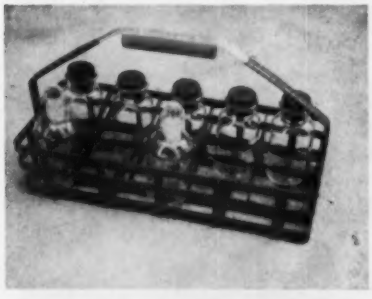
The new pumps can be driven by direct-connected electric motor, right-angle gear drive or flat-belt drive from gasoline or diesel engine.

Novel Holder for BOD Bottles

611

The City of Durham, North Carolina, in conjunction with the Dairy Filtering Products Co., has developed a carrier, designed for 10 round pint milk bottles, that has proved very convenient and serviceable for transporting 300 milliliter BOD bottles to and from the incubators as well as while in the water baths.

When the Durham plant was enlarged and modernized, a water bath type of BOD incubator, containing 22



separate baths each 23 by 24 in. was installed. It was found that the new 10 bottle carrier now makes possible the placement of three carriers in each bath.

After two years of use, the ease of placing and removing bottles from the water seems to justify the use of the carriers. The carriers have shown no signs of deterioration during the 2 years they have been in use.

CONTINUED ON PAGE 25A

Luxurious hotel protects the masonry of its reservoirs from leaking!

THORO System Materials employed for their sealing and waterproofing qualities

Workmen applying Thoroseal to heavy masonry structure required 30,360 *lbs. of Thoroseal*

Subterranean vaults house fuel oil and fresh water supply for Habana Hilton

Poured concrete rooms, two and three floors below basement level, were designed to house supplies of fresh water and fuel oil in the operation of the Habana Hilton in Cuba.

Although the masonry in these storage rooms was structurally sound, it was equally imperative that they be leakproof.

The **THORO** System materials were employed to seal the concrete structure of these unique rooms against leakage.

WATERPLUG, famous for its ability to stop leaks instantly, was applied to the joints where walls, floor and ceiling met and to anchor pipe and conduit fixtures.

THORITE, a twenty-minute set patching compound, was troweled into the honeycombing of the masonry.

THOROSET ingredient for hardening and waterproofing concrete was used in the mixture of a cement compound for trowel-coating over all surfaces.

THOROSEAL, applied in two heavy brush coats, sealed the masonry from all possible leakage.

THOROBOND, applied to the extra smooth sections of the poured masonry, made it possible to bond both **THOROSET** and **THOROSEAL** to the surface.

P & W Floor Hardener gave floors extremely hard wearing surface.

Write for our NEW 20 page brochure

Standard Dry Wall Products Inc.

NEW EAGLE, PA. CENTERVILLE, IND.

only ONE PUSH makes it PERMANENT...

AMERICAN Fastite®★★ JOINT* CAST IRON PIPE

Insert the single joint component—an exclusive dual-density, **double sealing** ★★ rubber gasket . . . lubricate the spigot . . . push pipe together . . . and you have a **permanent** bottle-tight joint.

That's American Fastite® Joint Cast Iron Pipe—American's new favorite for fast, simple installation and long service life.

American Fastite® Joint, an all-weather-laying joint, offers many special advantages for water, sewage and other liquid service.

Get the facts about American Fastite® and **compare** before you buy. Call your nearby American Cast Iron Pipe Company representative now.

*Patent applied for: Underwriters' Laboratories, Inc., approved.

See Booths 81-82,
Annual AWWA Conference,
San Francisco, July 12-17

AMERICAN
CAST IRON PIPE CO.
BIRMINGHAM ALABAMA

SALES OFFICES
New York City • Dallas
Chicago • Kansas City
San Francisco • Denver
Pittsburgh • Orlando
Minneapolis • Cleveland
Birmingham

Equipment News

CONTINUED FROM PAGE 23A

Flow Rate Calibrator

612

Brooks Rotameter Co., Lansdale, Pa., has developed a volumetric displacement calibration stand for calibrating small flow devices to accuracies within 0.2 percent.

In operation a volume of fluid is accurately measured and automatically timed as it passes through the unit being calibrated and then into a collecting chamber. The system employs a "free-piston" operating in a straight wall precision-bore glass tube as the collecting chamber. A groove around the circumference of the piston is filled with mercury to form a perfect and virtually frictionless seal between the glass tube and the piston.

Elimination of vapor pressure, gas and liquid solubility factors, provision for hermetic sealing, and low constant back loading and extremely simple operation are among the advantages of this calibrator.

High Head Centrifugal Pumps

613

Rice Pump & Machine Co., Belgium, Wis., has introduced a complete new line of self-priming high head centrifugal pumps in sizes 1½ in. thru 6 in. Pumps are available with base mounting, pneumatic tires or steel wheels. Units may be belt driven, flexible coupling driven, or direct connected engine driven.

Sizes 1½ thru 3 in. are available with electric or air-cooled gasoline power. Sizes 4 thru 6 in. are available with electric, gasoline, or diesel power.

Improved Cation Regeneration Method

614

Graver Water Conditioning Co., New York, N. Y., has developed a cation regeneration method that is said to result in lower electrolyte leakage, greater uniformity of effluent quality and reduced operating cost.

The method, known as "FBR" Regeneration (for Fixed-Bed Reverse

CONTINUED ON PAGE 27A

KING
PAINT MAKERS SINCE 1834

SPECIALISTS and PIONEERS IN COATINGS SYSTEMS for POTABLE WATER STORAGE UNITS

400,000 Gal. Elevated Tank Newton, Mass.

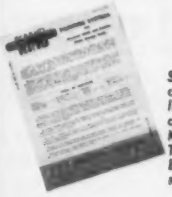
1,000,000 Gal. Standpipe, Holden, Mass.

INSIDE and OUT . . . protected from rust, corrosion and odor by KING TANK COATINGS SYSTEMS Whether in fabrication, initial painting, or field repainting, KING TANK COATINGS SYSTEMS are specifically formulated with these exclusive proven advantages:

1. Non-toxicity
2. No Taste Impartment
3. Corrosion Prevention
4. Maximum Durability

TRIPLE LEADKOTE or ZDO-120

systems for painting interiors of potable water tanks and standpipes offer defense in depth against corrosion, defense in formulation against improper application. See why some 80% of the Municipal water storage tanks in New England alone are protected with KING TANK COATINGS.



Send for Bulletin 57070, a comprehensive 7 page booklet giving full analytical and application specifications on KING TANK COATINGS SYSTEMS. This is not a sales brochure, but a strictly technical work.

KING DIVISION THE WILBUR & WILLIAMS CO., INC.
FACTORY AND GENERAL OFFICES
662 Pleasant St., Norwood, Mass.

Gentlemen:
Please send Bulletin 57070 to:
Name .....
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Company .....
Address .....
City ..... Zone ..... State .....

Major new development

THE CLOROBEN UP-SEWER CHEMICAL ROTATION METHOD

(U. S. Patent Applied For)

Here is an entirely new and remarkably effective way to eliminate conditions in sewage collection systems that cause local odor and grease problems, and which also adversely affect final treatments.

With the Cloroben Up-Sewer Rotation Method, accumulated grease deposits and slime formations are dissolved; high sulfide production eliminated.

The Cloroben Up-Sewer Rotation Method consists of two major steps. First a shock treatment of isolated local areas where excessive accumulation of grease and slime has occurred. Then, a preventive maintenance program using the principle of periodic shock dosing of local up-sewer lines.

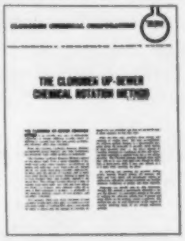
By shifting and rotating the up-sewer dosing points, laterals, branch sewers, lift stations, wet wells and force mains will periodically receive an application sufficient to prevent any further excessive formation of grease and slime deposits.

Up-sewer treatment using the Cloroben Rotation Method gives any sewage collection system the same proven benefits enjoyed by many cities now using Cloroben. Cloroben dissolves accumulated grease and slime deposits in sewer lines, lift stations, wet wells, and force mains.

With Cloroben, sulfides are suppressed and odors eliminated. Roaches and mosquito larvae are killed. Corrosion of metal, brick and mortar is inhibited with resultant savings in labor and other maintenance cost.

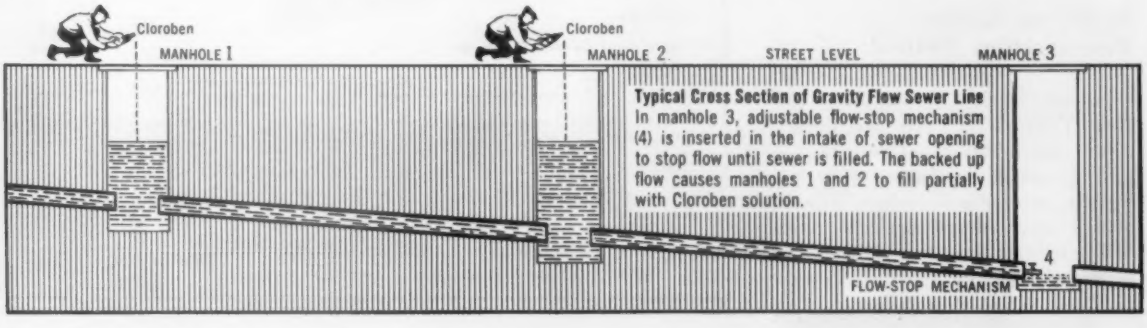
The Cloroben Up-Sewer Rotation Method will assure the delivery of a non-septic, stabilized influent to the final treatment plant.

FREE: Technical bulletin, just prepared, gives complete facts about Cloroben Up-Sewer Chemical Rotation Method, includes directions for odor and grease control, cleaning of wet wells, force mains and sewer lines. Write for your copy, without obligation.



CLOROBEN CHEMICAL CORPORATION

115 Jacobus Avenue
South Kearny, New Jersey
Subsidiary of
Standard Chlorine Chemical Co., Inc.
New Jersey: Mitchell 2-1703
New York: Barclay 7-4443



Typical Cross Section of Gravity Flow Sewer Line
In manhole 3, adjustable flow-stop mechanism (4) is inserted in the intake of sewer opening to stop flow until sewer is filled. The backed up flow causes manholes 1 and 2 to fill partially with Cloroben solution.

Equipment News

CONTINUED FROM PAGE 25A

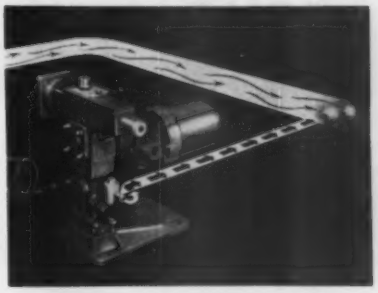
Flow), consists basically of a means of flowing regenerant up instead of down while maintaining a fixed, rigid resin bed. A fixed bed prevents channeling or short-circuiting of the regenerant solution.

By pumping acid up through the bed, the band of resin richest in hydrogen is at the bottom which is the point the water being treated touches last before leaving the unit. This rich band becomes a scrubber zone and reduces "leakage" so that a purer effluent is produced.

Automatic Metering Pump

615

Hills-McCanna Company, Chicago, Ill., has developed a compact and packless Pneumatic Stroke Controlled McCannameter that automatically proportions chemicals to any main line flow. Utilizing its pneumatic stroke controlled instrumentation, the pump maintains a constant discharge in proportion to the main line flow. Operating on a 3 to 15 psig air signal, the instrument requires no additional



power source of air, responds instantaneously to eliminate backflash and keep chemical-discharge-to-flow ratio precisely accurate.

General Purpose Valve

616

Stokham Valves & Fittings, Birmingham, Ala., has developed a new non-lubricated general purpose valve with two Teflon "O" rings in the face of the plug.

Called the Wedgeplug "O-Seal," it will effectively double-block and bleed in most services to do the job of two ordinary valves or a line blind.

The "O-Seal" is non-lubricated and requires no maintenance. The pressure sealing effect of the "O" rings provides absolute shut-off that remains permanently "bubble-tight".

Operation of the new valve is quick and easy. Other advantages include protected seats, double seating for pressure-sealing effect at both the upstream and downstream sides, and the assurance of no contamination.

Manometers

617

Trimount Instrument Co., Chicago, Ill., has available two manometers of new design that are said to represent advanced engineering concepts in the field of manometry.

The new manometers are designated Models C-22 and C-12, and their exterior design is highlighted by a black scale with white numerals and incre-

CONTINUED ON PAGE 37A

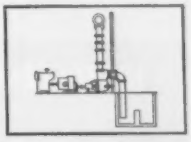
GORMAN-RUPP SEWAGE PUMP

costs less to buy . . . less to operate, maintain

Have you discovered the tremendous advantages of this self-priming centrifugal pump by Gorman-Rupp?

In installation after installation, in lift stations and treatment plants, this amazing unit has shown an outstanding record of success. In a typical instance, less than *half* the cost of alternate equipment. And the maintenance has been almost nil.

Here are the facts: self-priming in lifts up to 15 feet, positive in action, nearly completely non-clogging. Removable end plate provides fast access to impeller and wear plate with just a turn of the wrist. No longer need pump servicing be done in the pit or by raising whole unit by crane. Unit is high and dry. The non-clogging impeller passes spherical solid as follows: 3″ pump, 1½″ solids; 4″ pump, 2″ solids; 6″ pump, 2½″ solids.



Write today for details. You'll be delighted at the low price and record of performance.

THE GORMAN-RUPP COMPANY

305 Bowman Street Mansfield, Ohio

Nichols Herreshoff

The Versatile Sludge Furnace...

Only the Nichols Furnace provides this multi-purpose operation . . . Grit, Grease, Screenings and Sludge may be disposed of singly or together in ONE burning operation.

Sludge may be burned or dried in one compact unit.

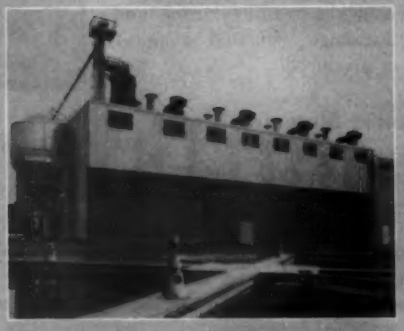
The furnace is a self-contained unit and requires small installation area. Operation is simple, dustless, odorless and presents no hazards. Self-controlled combustion insures freedom from smoke or noxious odors.

Rugged construction assures long life and low maintenance.

Pictured at right are a few of the recent Nichols Herreshoff installations.

Our engineers will be happy to provide more detailed information and assist in the solution of your sewage solids disposal problem—no obligation, of course.

Marietta, Ohio — Consulting Engineers Alden E. Stilson & Assoc.



Indianapolis, Ind. — Consulting Engineers Moore & Hegar

Nashville, Tenn. — Consulting Engineers George P. Rice—The Chester Engineers

Mill Creek, Cincinnati, Ohio — Consulting Engineers Havens & Emerson

NICHOLS ENGINEERING & RESEARCH CORP.
70 Pine St., New York 5, N. Y.
3513 N. Hovey St., Indianapolis 18, Ind.
405 Montgomery St., San Francisco 4, Calif.
1477 Sherbrooke St. W., Montreal 25, Canada

Cleans up to 120 feet of sludge bed per hour

Mechanical cleaner provides faster and more efficient sludge removal than conventional hand cleaning methods

Here's a mechanized method of cleaning sludge beds that will pay for itself in a relatively short time. While individual savings depend on such variables as size of plant, available manpower, method of disposal, etc., annual savings of 60% have been reported over conventional hand cleaning.

The sludge bed cleaner offered by Link-Belt is essentially a conveyor system on wheels . . . the system is mounted on a standard tractor, which travels on concrete runways in sand beds and cleans a path up to 26 feet in width. Performance-proven Link-Belt conveying and power transmission components are combined into an efficient mechanism that is operated by hydraulic motors.

The cleaning cycle works like this. Forked scoops assure minimum loss of filter bed sand. The scoops are raised alternately, elevating the sludge and chuting it over a front truss. Sludge is conveyed by two wing conveyors into a trough where it is pushed along by a center longitudinal flight conveyor. This conveyor carries the sludge up a 45° incline where it is deposited in a truck that is towed or driven behind the tractor.

For more detailed information on how you can clean sludge beds faster, more efficiently, call your nearest Link-Belt office. Send for Folder No. 2671.

LINK-BELT

SANITARY ENGINEERING EQUIPMENT

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. Sanitary Engineering Regional Offices—Colmar, Pa., Chicago 9, Kansas City 8, Mo., San Francisco 24. Sales Offices in All Principal Cities. Export Office, New York 7. Representatives Throughout the World. 14,902

K&M ASBESTOS-CEMENT SEWER PIPE

Sewer pipe maintenance headaches disappear when you install "K&M" Asbestos-Cement Sewer Pipe.

Flow-stopping, pipe-clogging roots . . . no matter how cobwebby-thin . . . can't penetrate the exclusive patented "K&M" FLUID-TITE coupling . . . unmatched in its tight sealing. In repeated tests, "K&M" Asbestos-Cement Sewer Pipe successfully resisted infiltration even when external water pressure was 25 psi . . . the equivalent of a 58-foot head and way above field conditions.

Service remains continuous and uninterrupted . . . with fewer inspections and periodic cleanings. You can reduce treatment loads and costs . . . because infiltration is eliminated. Being made of quality asbestos fibers and portland cement, "K&M" Sewer Pipe does not corrode and is immune to electrolysis.

In fact, "K&M" Asbestos-Cement Sewer Pipe is a tax-saver at every stage of construction: planning and installation, as well as maintenance. Transportation and handling is less expensive, because "K&M" Asbestos-Cement Sewer Pipe is light in weight.

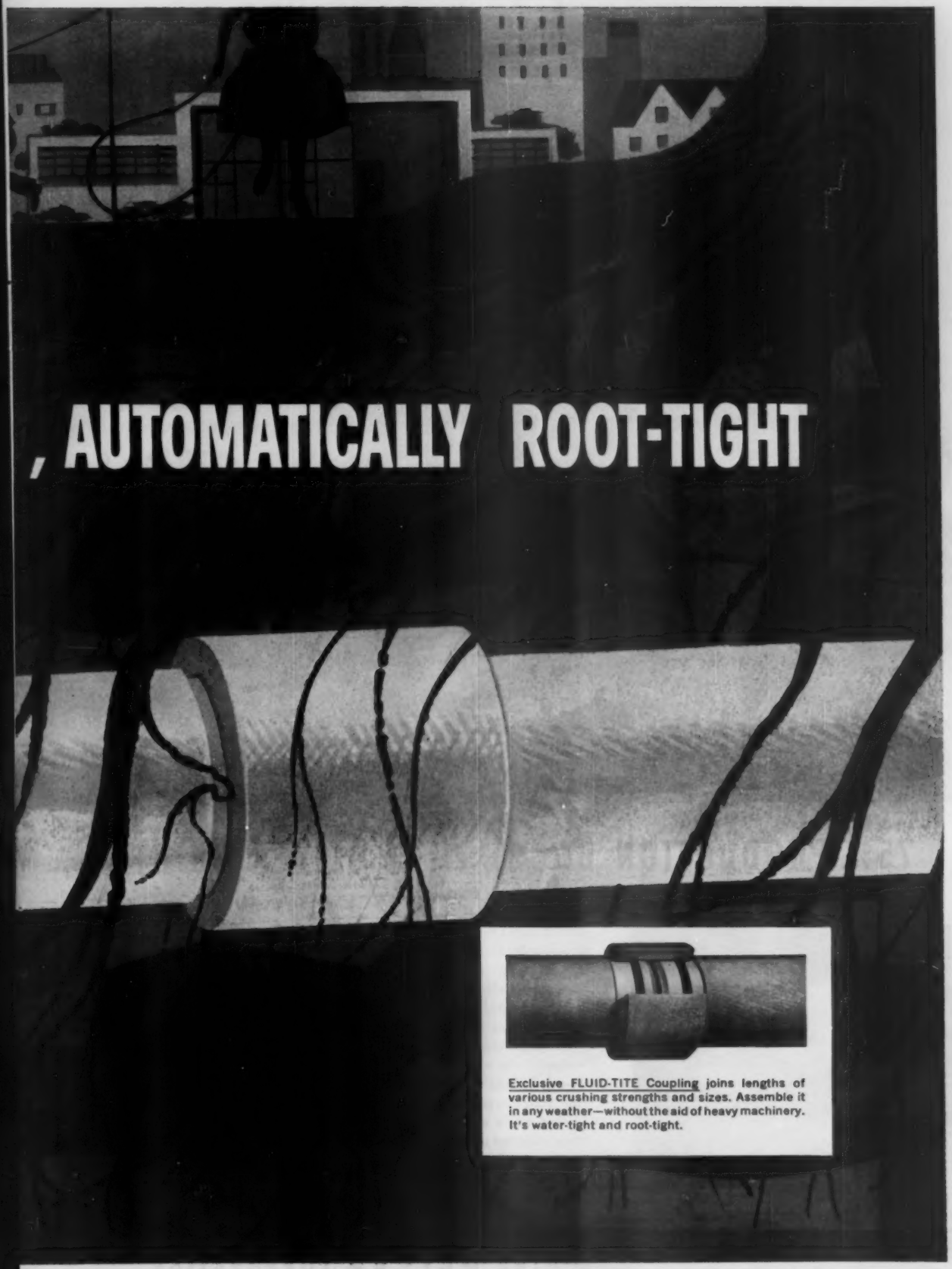
In short, practically indestructible materials plus eighty-five years of asbestos engineering give you the finest, most dependable sewer pipe available. That's why we urge you to write today for more information.

5 CRUSHING STRENGTHS OF K & M SEWER PIPE

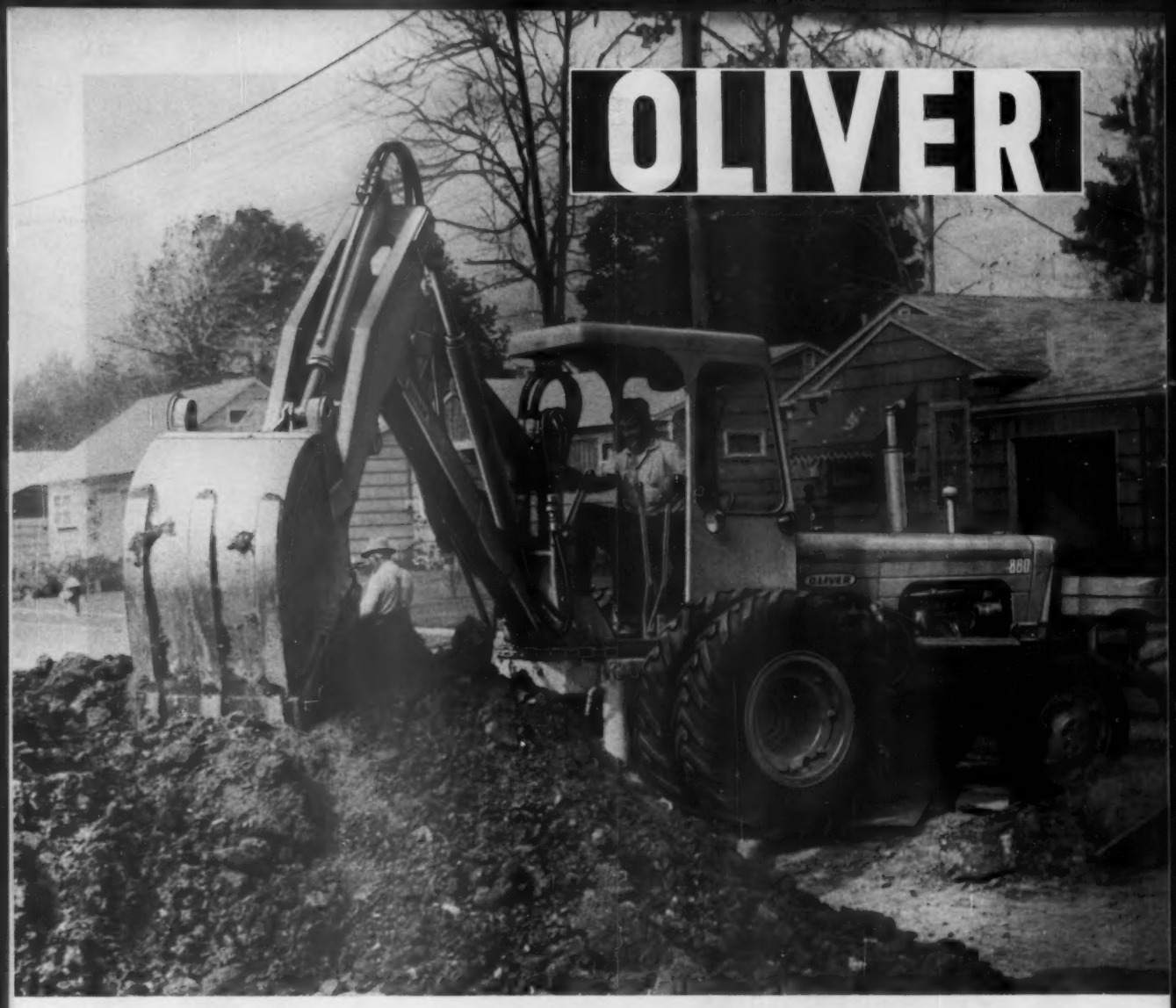
Size Inches	Class 1800	Class 2400	Class 3300	Class 4000	Class 5000
6	1500	2400	3300		
8	1500	2400	3300		
10	1500	2400	3300	4000	5000
12	1500	2400	3300	4000	5000
14	1500	2400	3300	4000	5000
16	1500	2400	3300	4000	5000

K·M
BEST IN ASBESTOS

KEASBEY & MATTISON
Company • Ambler • Pennsylvania



Exclusive FLUID-TITE Coupling joins lengths of various crushing strengths and sizes. Assemble it in any weather—without the aid of heavy machinery. It's water-tight and root-tight.



75% PRODUCTION BOOST WITH OLIVER 80-HT

—says New York contractor

The Oliver 880 tractor can also be equipped with a factory-matched 1-yd. bucket—making it a true heavy-duty loader. This unit is highly mobile, with travel speeds from 2 to 17 m.p.h. Gas or diesel power.

When this Oliver Model 80 Hydro-Trencher "took over" the job of digging 50-foot laterals in the rocky shale of Staten Island, Patsy Iaizzo, local contractor, happily noted two important benefits: 1. An immediate 75% increase in production over any of the three trencher combinations that he had been using. 2. A saving of at least $90 per month in fuel alone.

Savings like this are common among owners of this combination —the Oliver 880 tractor equipped with the Model 80 trencher. The ½-yd. bucket digs and loads to 12 feet. The boom swings 180° and the dual-circuit hydraulic controls allow raising or lowering the bucket while swinging. Result: faster work cycles. Now municipalities, utilities and contractors can rip out pavements, dig in hardest soils (even frozen ground)—and do these jobs with a unit that can travel anywhere on busy streets.

Your dependable Oliver distributor will gladly demonstrate—on your job. Call him today or write for literature.

OLIVER **THE OLIVER CORPORATION**

Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio

a complete line of industrial wheel and crawler tractors and matched allied equipment

Keep repair shop expenses down

Use

HERSEY

WATER METERS

Nationally known for low Maintenance

Costs and long, accurate

Registration

HERSEY MANUFACTURING COMPANY

(Established 1859)

DEDHAM, MASS.

BRANCH OFFICES: NEW YORK — PORTLAND, ORE. — PHILADELPHIA — ATLANTA — DALLAS — CHICAGO
SAN FRANCISCO — LOS ANGELES

"You can't buy a better Water Meter than HERSEY."

There's only ONE

TARSET®

Coal Tar-Epoxy Resin Coating

IF you're confused by the number of coal tar-epoxy resin coatings on the market today, perhaps these few brief facts will clear the air:

1. Pitt Chem TARSET is the *first* patented coal tar-epoxy resin coating on the market.

2. No other coal tar-epoxy resin coating duplicates the exclusive TARSET formula. It has not been made available to anyone else.

3. Only TARSET coal tar-epoxy resin coating is backed by a *five* year record of outstanding performance in the field.

Do *you* have an unusual corrosion problem in the marine, chemical, petroleum, pulp and paper, water and sewage, or general plant maintenance field? Then you should know more about the revolutionary ability of TARSET to stop corrosion where most other practical methods fail. And to do it at relatively low cost. *Call your industrial distributor for more information . . . today!*

PITT CHEM Industrial Coatings are available through leading Industrial Distributors. See the "Yellow Pages."

★ PITT CHEM "Tarmastic"® Coal Tar Coatings
★ PITT CHEM "Insul-Mastic" Gilsonite Coatings
★ PITT CHEM "Tarset" Coal Tar-Epoxy Coatings

PROTECTIVE COATINGS DIVISION
PITTSBURGH
COKE & CHEMICAL CO.
Grant Building • Pittsburgh 19, Pa.

WSW 7370

PROTECTIVE COATINGS • COAL CHEMICALS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON • FERROMANGANESE

This high temperature, high pressure test apparatus is used to induce changes in existing materials to produce new materials. From such experiments come new equipment efficiencies and economies.

This is a PICTURE OF A NEW PRODUCT

Products for Industry: Electrical Generation, Distribution and Utilization Equipment; Pumps; Compressors; Mechanical Power Transmission Equipment; Processing Machinery; Motors and Control; Water Conditioning Systems, plus Materials Handling Equipment.

No, it won't be available tomorrow—or even next year. But Allis-Chalmers is working on it *now* to meet the needs of public works in the future.

Continuous Research — at Allis-Chalmers — of materials, processes and equipment paces product development and technological advancement. *Creating a continuous flow of new equipment, improving existing products, helping public works and industry achieve new efficiencies and economies* — these are the assignments of Allis-Chalmers research.

Thus research contributes to establishing a pronounced preference for Allis-Chalmers public works equipment. But it's only part of the story. Single-source availability of "teamed" equipment, invaluable engineering help and outstanding service facilities are other important factors.

Talk to your A-C representative soon about your requirements. Or write Allis-Chalmers, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE

ALLIS-CHALMERS

A-1004-PW

new heavy duty MUELLER®

CHECK VALVES

Specifically designed for repeated opening and closing applications.

■ These new, heavy duty Water Works Check Valves have been specifically designed to reduce wear caused by repeated opening and closing when used in such installations as pump suction or discharge lines. ■ All working parts are heavily constructed from high-strength materials to assure long, dependable operation without maintenance. A new combined hinge pin and plug is held to the body by studs and nuts. An "O" ring positively seals the plug to prevent leakage. Large, wear-resistant bearings assure alignment and rigidity of the gate to reduce chatter and vibration. A heavy stainless steel hinge pin is used on all lever and weight type and lever and spring type check valves. ■ The many exclusive features of these new, heavy duty check valves are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product made for the water industry.

Write today for complete information and specifications.

MUELLER CO.
DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles; In Canada: Mueller, Limited, Sarnia, Ontario

ideal for use in:

PUMPING STATIONS
SEWAGE TREATMENT PLANTS
FILTRATION PLANTS
INDUSTRIAL PLANTS

Iron Body — Bronze Mounted
Flanged, Screwed or Hub Ends
Working Pressure: 175 p.s.i.
Sizes: 4", 6" and 8"

Equipment News

CONTINUED FROM PAGE 27A

ments. Cases of both models are of extruded aluminum with gold anodized finish. The basic difference between the two models concerns the well: Model C-22 is a well type manometer while Model C-12 is a raised well type. Operating data of the models are identical, with maximum operating pressures of 400 psig and ranges from 12 to 130 in. Fluid contacted part on both models are 18-8 stainless steel and pyrex.

Trench Drills

618

The Salem Tool Co., Salem, Ohio has introduced a complete new line of trench drills which permit contractors to drill holes and lay pipe without breaking paving or disturbing the surface and disrupting traffic. The units have drilled and pushed pipe as far as 250 feet and are limited only by pipe weight and earth or rock formations to be drilled.

In practice the drill operates in a trench dug to the depth at which the pipe is to be laid. The drill is placed in the trench with a sideboom tractor or truck-mounted winch. The auger rotates inside the pipe and advances the pipe as the hole is drilled. The hole is drilled and pipe pushed simultaneously. The auger flights feed the drilled earth back through the pipe.

The drills handle augers 4 to 24 in. in diameter and 2 to 6 ft in length. All drills have variable hydraulic feed installed in a rigid frame for drilling accuracy.

Portable Corrosion Tester

619

Soiltest, Inc., Chicago, Ill., has developed a new lightweight corrosion tester that reads directly in microinches of corrosion.

The unit is battery operated and applies AC Current to the probes, eliminating polarization and undesirable side effects. A single knob controls a sensitive transistorized bridge circuit which works on the null prin-

CONTINUED ON PAGE 45A

ONLY FROM KUHNS

DUCTILE

IRON PIPE FITTINGS

Kuhns long lasting ductile iron pipe fittings for high strength and corrosion resistance are pressure rated by Underwriters' Laboratories, Inc. Most types and sizes are stocked for prompt delivery, along with our complete line of high quality cast and malleable iron fittings. Write for catalog today.

THE KUHNS BROTHERS CO.

1800 McCall St. • Dayton, Ohio

OVER 3,000 SHAPES AND SIZES

Watch for it in August . . . the new 1959 . . . . . WATER & SEWAGE WORKS

Reference Number

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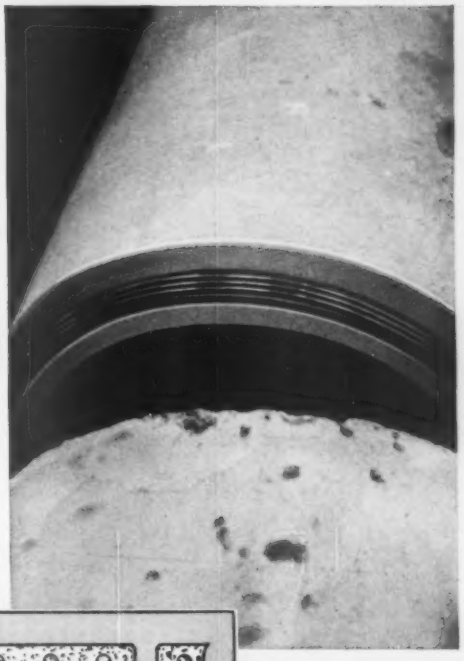
FLEXIBLE RUBBER PIPE GASKETS



TYLOX RUBBER GASKETS are specified and used by engineers and contractors the world over to assure faster pipe-laying and water-tight, long-lasting lines. Proof of this engineering preference is the fact that there are more TYLOX Gaskets in low head service today than all other types of gaskets combined. Here are a few of the reasons why:

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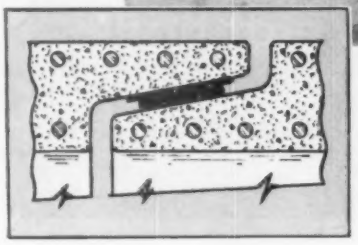

Acid-resistant TYLOX RUBBER JOINTS seal water-tight by compression, and outlast the pipe itself.

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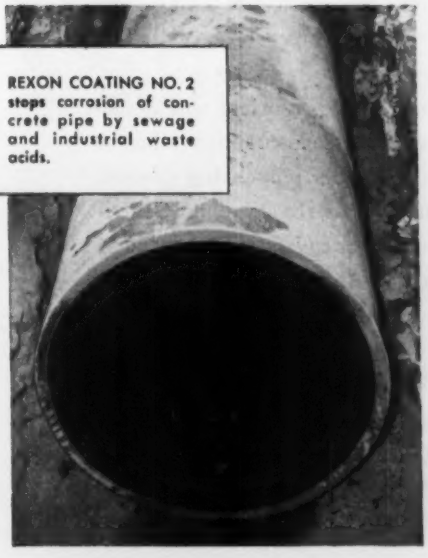

REXON COATING NO. 2 stops corrosion of concrete pipe by sewage and industrial waste acids.

REXON COATING NO. 2 offers engineers an *extra* safety factor against acid attack on concrete pipe sewers in installations where corrosion is extreme. REXON NO. 2 is applied quickly by brushing or spraying on the pipe, inside and out. It forms a tight, lasting, water-proof bond to the concrete, and is resistant to virtually all acids, alkalies, oils, greases and solvents.

SPECIFY TYLOX RUBBER GASKETS AND REXON COATING NO. 2 FOR YOUR CONCRETE PIPE JOBS. WRITE FOR MORE DETAILS.

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KENT, OHIO

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Spotted on this map are some of the places that have been served by the Centriline Process

Chances are that one of your colleagues has rejuvenated some of his city's piping by Centriline reconditioning. Here's your chance to find out.

Briefly, this process smoothly lines piping—*in place*—with cement-mortar, creating a pipe-within-a-pipe. This vastly increases carrying capacity, stops leakage, prevents corrosion and tuberculation, and prolongs pipe life indefinitely. Pressure goes up, pumping cost goes down, and there's no need to disturb traffic to replace mains. Over 6,000,000 feet of piping, from 4" to 144" diameter, have been treated by Centriline. *Ask your neighbor.*

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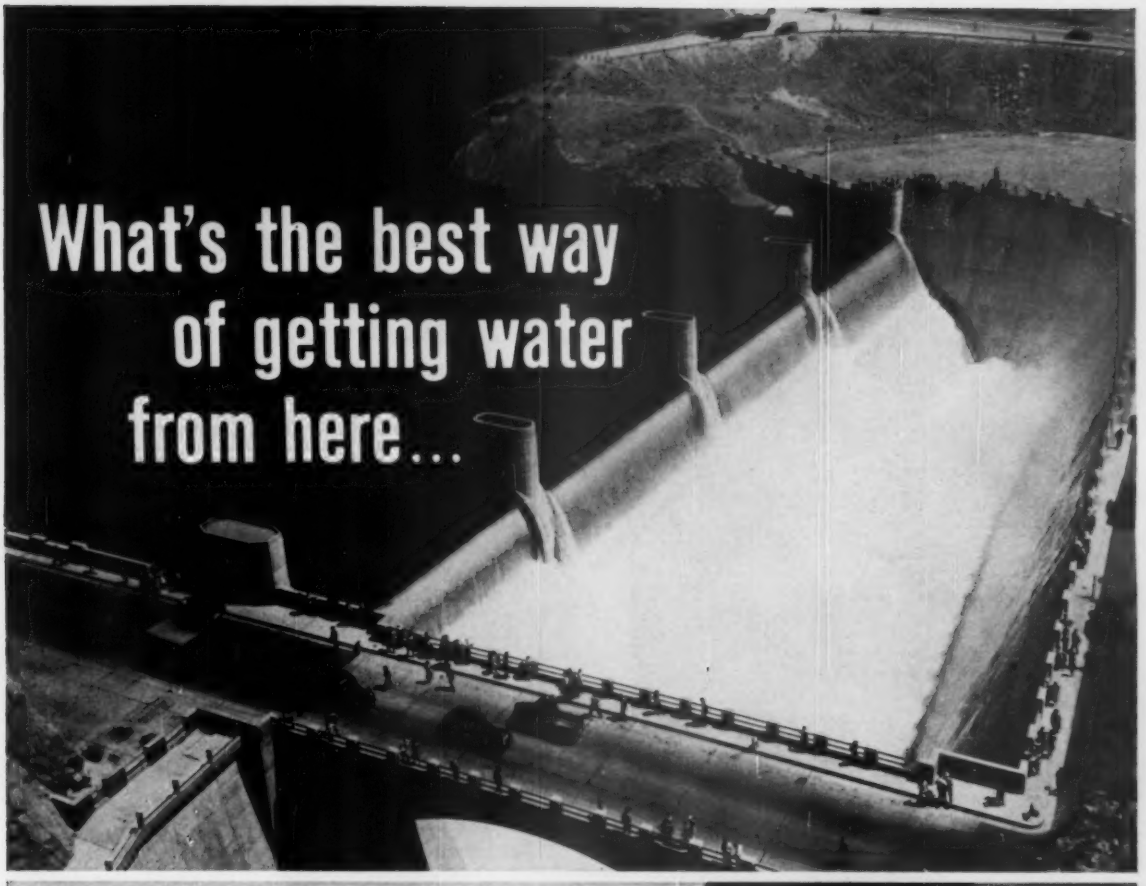
What's the best way
of getting water
from here...

to here?
(turn the page)

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Installation of 2000 feet of 12-inch mechanical joint cast iron pipe along state highway.

Why do we say that?

This year, as every year, more miles of underground cast iron water mains are in use than all other kinds of pipe combined.

Furthermore, more miles of cast iron water mains are now being purchased and laid than of any other kind of pipe.

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Eight-inch cast iron pipe ready for installation of 2-main water system in new subdivision.

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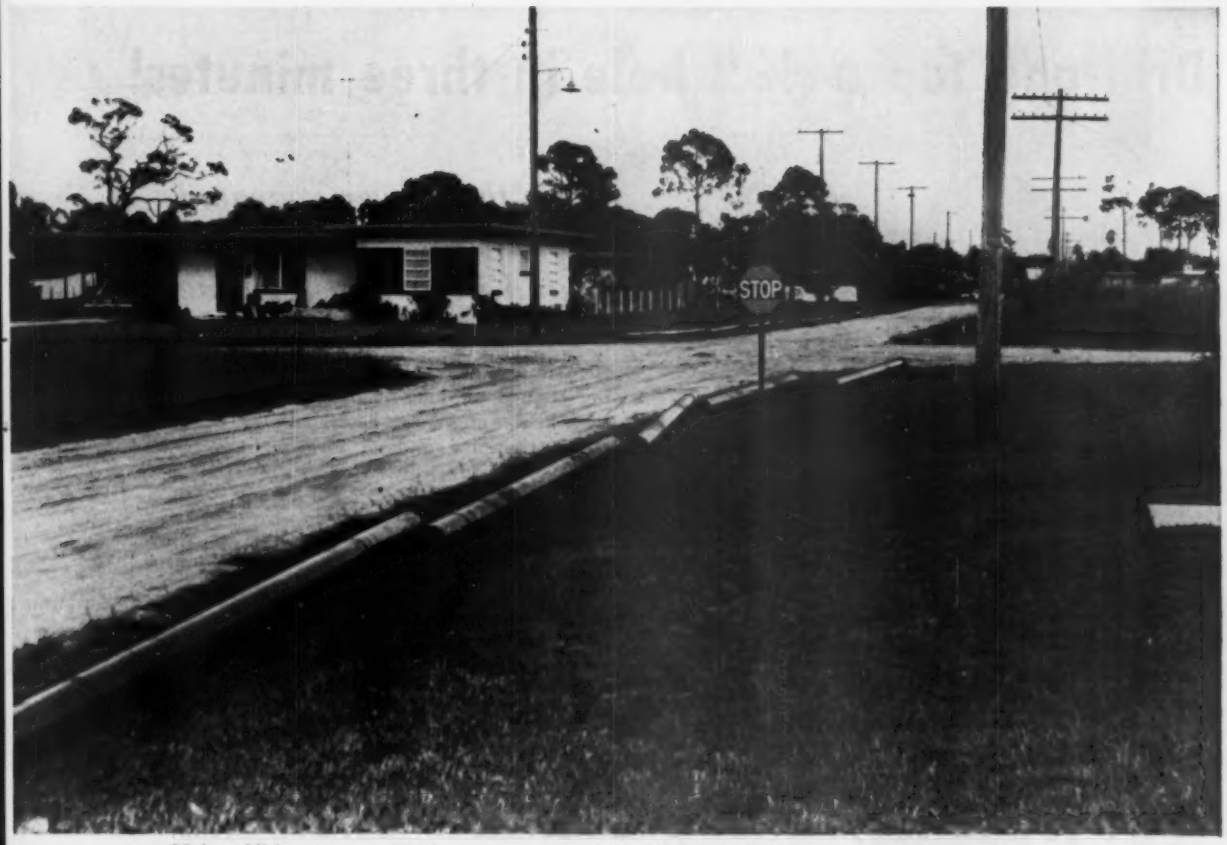

Major additions to a municipal water system totaled 116,080 feet of slip-on joint cast iron pipe in 6-, 10- and 12-inch sizes.

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What are its advantages?

- LONG LIFE. The cast iron pipe you install today will be performing economically a hundred years from now.
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- GREAT BEAM STRENGTH. Cast iron pipe resists the effect of heavy traffic, shifting soils.
- TREMENDOUS LOAD RESISTANCE. Six-inch cast iron pipe (Class 150) withstands a load of nearly nine tons per foot!
- PRESSURE-TIGHT JOINTS. You have a complete choice of leakproof, easy-to-assemble joints. You need a minimum of tools and work crew.
- EASE OF TAPPING. No tapping saddles needed. Takes threading best of all kinds of pipe.

. . . good reasons for you to choose

CAST IRON PIPE

THE MARK OF THE 100-YEAR PIPE

Write for complete information to Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Ill.

Drill and tap a ¾" hole in three minutes!

use the power-operated MUELLER® *B-100 drilling, tapping and inserting machine*

Reduce time and effort to a minimum on all of your service connection jobs by using the new Mueller B-100 Machine and Air or Electric Power Operator.

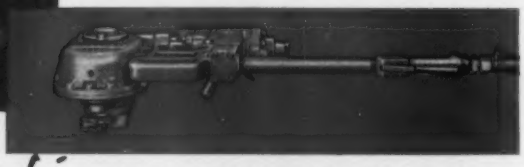
Drilling, tapping and withdrawing the tool is done quickly and easily with power. Tool feed, during the drilling operation, is automatic to insure fast, accurate cuts. Crowding of the tool is completely eliminated — greatly extending effective tool life.

Either type of power operator attaches directly to the top of the boring bar *and* to the square shank on the top of the feed yoke. No adapters or conversion parts are needed — simply lift off the ratchet handle. Both power units are reversible.

The modern, new "B-100" is far ahead of any other tapping machine available. It is typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product manufactured for the water industry.

Write for complete information.

H-603 ELECTRIC POWER OPERATOR
110-120 Volt A.C.-D.C.



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90 p. s. i. pressure at full load

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles;
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Equipment News

CONTINUED FROM PAGE 37A

ciple with only one dial adjustment necessary for all readings.

Supplied as accessories to the Corro-Dex corrosion meter are temperature compensated electrical re-

sistance probes. Probes are available in various metals and in thickness of 1.10 and 40 mils with life rates of 100 hours, 30 days and six months.

Corrosion Resistant Shut-Off Gates

620

Beaumont Birch Co., Philadelphia, Pa., has developed a new line of dustite, self-cleaning double rack and pinion shut-off gates. In addition to the trouble-free operation of the gates, one of the features is the design of the gate plate which is renewable with material in the field without replacing racks.

Standard features for the 12 thru 30 in. gates include: deep U-section gate plate assembly; open tooth corrosion resistant aluminum alloy racks; self-cleaning cast iron pinions located above racks; lapped seal on all four sides of gate plate; cast aluminum gasketed access doors; ⅜ in. steel plate body with ¾ in. thick flanges; external grease fittings for all rollers and bearings; relief chamber for displaced material when closing through standing column; handwheel, chainwheel, ratchet, cylinder of motor operated; stud or flange top with any combination of round or square top and bottom openings.

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Ferri-Floc

FERRIC SULFATE

Ferri-Floc TC FERRIC SULFATE

FERRI-FLOC produces rapid Floc Formation — Controls Taste and Odors — Coagulates Over Wide pH Range — Increases Filter Runs — Removes Turbidity, Color, Manganese, Silical and Bacteria . . . Ferri-Floc is a free flowing granular salt that can be fed through most standard dry feed equipment . . . Ferri-Floc is easy to handle and will keep for long periods of time in closed hoppers.

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Coagulates over wide pH ranges and provides efficient operation regardless of rapid variations of raw sewage — Very effective for conditioning sludge prior to vacuum filtration or drying on beds.

COPPER SULFATE safely controls about 90% of microorganism normally encountered in water treatment plants efficiently and more economically than any other chemical.

COPPER TC SULFATE

SULFUR DIOXIDE is used most effectively for dechlorination in water treatment and to remove objectionable odors remaining after purification.

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FREE BOOKLET

Let us send you without charge, a 38-page booklet that deals specifically with all phases of coagulation—just send us a postal card.

TC TENNESSEE CORPORATION

TENNESSEE CORPORATION

Inset photo shows the Christy contour gasket applied around an ALOXITE porous plate. Effective sealing is demonstrated in the installation photo that is shown above.

New contour gasket forms positive seal between ALOXITE® plates—simplifies installation

A new "plus" is now added to the advantages of ALOXITE aluminum oxide porous-plate underdrains . . . a faster, greatly simplified and thoroughly positive method of sealing between plates, entirely without joint cement!

The new method involves use of a synthetic contour gasket that fits around each plate. When the plates are laid as shown above, the gaskets form a tight, continuous joint. A bead molded around the gasket insures close contact.

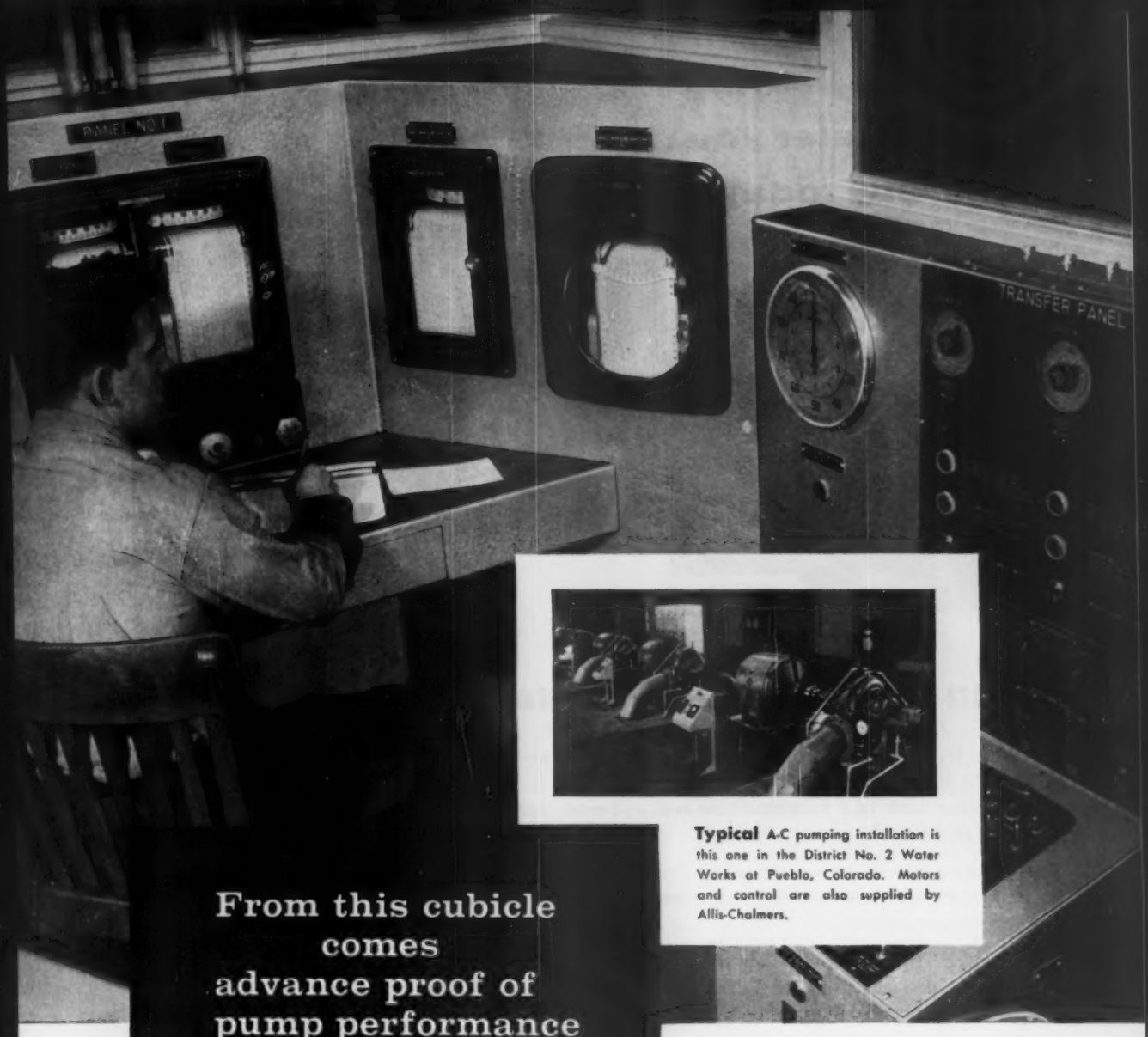
Since jointing with cement or asphaltic compounds is eliminated, effective sealing no longer depends on care in applying cement or attention to temperature and consistency. Pores cannot be clogged, as sometimes happens, by cement slopping over onto the plates. Installation time is reduced. If it ever becomes necessary, individual plates can be readily removed or replaced at any time without breakage or damage to the rest of the bottom.

The new gaskets are sold for about 50¢ each by the Christy Firebrick Company, 506 Olive Street, St. Louis 1, Missouri. They are available from stock.

For further information on ALOXITE porous underdrains write Dept. X-69, Refractories Division, The Carborundum Company, Perth Amboy, N. J.

CARBORUNDUM

Registered Trade Mark



From this cubicle comes advance proof of pump performance

Typical A-C pumping installation is this one in the District No. 2 Water Works at Pueblo, Colorado. Motors and control are also supplied by Allis-Chalmers.

This master control room of Allis-Chalmers pump test floor is far removed from public works installations. Yet, engineers working here know exactly what your needs are — and which Allis-Chalmers pump will best do the job.

Suction heads, discharge heads, gpm capacity, required horsepower plus other essentials for satisfactory pumping performance are all proven in advance.

Performance testing like this is only one reason why A-C is recognized as a full-line leader in meeting the pump needs of municipals. "Teamed" motors and control; customized standardization of parts and materials; engineering assistance and nationwide service are others.

Whatever your requirements in centrifugal pumps — from the smallest to 250,000-gpm giants — contact your A-C representative or distributor. Or write to Allis-Chalmers, General Products Division, Milwaukee 1, Wisconsin.

Plan to stay ahead... MODERNIZE!

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will it meet *1988* standards?

When buying new water meters, a most important question of cost is: "In 30 years will this meter be *scrapped,* or will it be rebuilt to *1988* standards at a fraction of the cost . . . ready for years more accurate service?"

Take a look at the *past* 30 years. Think how much you're saving *this* year on Trident meters installed back in 1928 . . . or even 30 years before that.

Under Trident's strict policy of interchangeability, all improved parts are designed to fit old Tridents too. These up-to-date Trident parts embody every thoroughly tested advancement known to metering science. Not only is repairing easy and economical, but also you actually modernize your Tridents as you go.

This has been a rigid Neptune policy for 60 years. *Every design improvement now on our drawing boards will continue it.* It's your best assurance that the Tridents you buy today will stay modern, earning maximum revenue for your water system . . . at lowest cost . . . for many years to come.

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TRIDENT WATER METERS

Vol. 106, No. 6 · June, 1959

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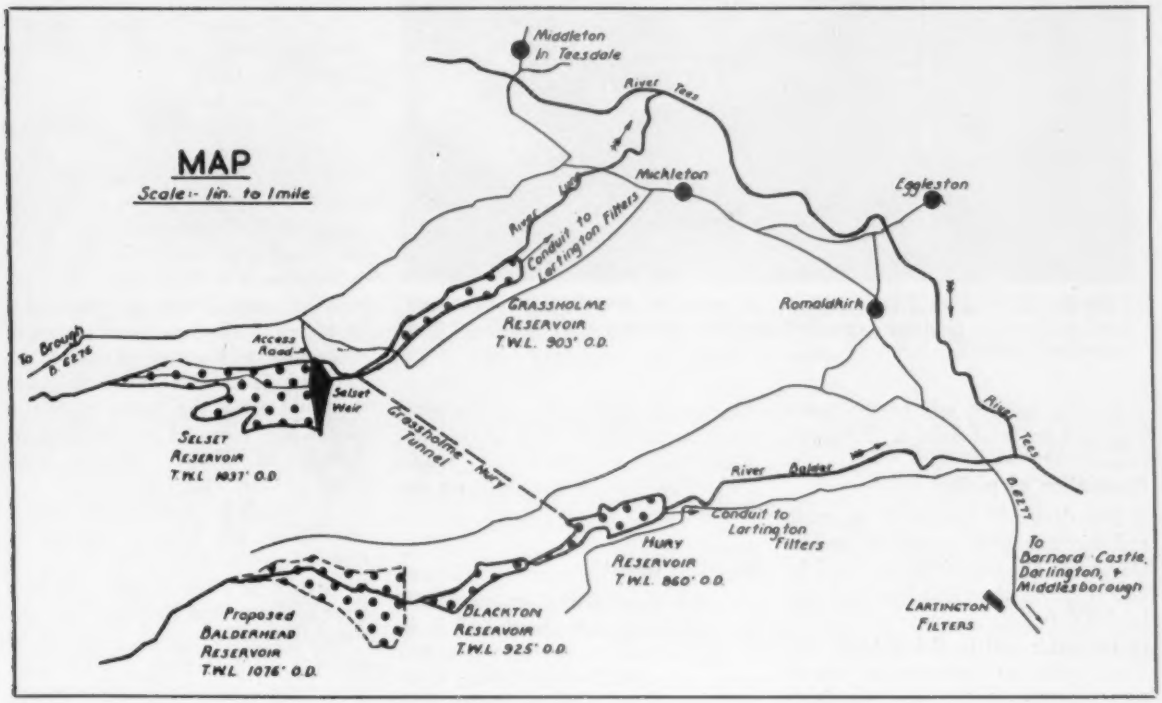
WATER & SEWAGE WORKS



NORTH YORKSHIRE ENGLAND water supplies increased by 17 mgd by . . .

Selset Reservoir

By WALTER SEKULES,
London, England

EDITOR'S NOTE: An 8.5 million dollar reservoir is under construction in North Yorkshire to increase water supply to one of England's major centers of heavy industry. Known as Selset Reservoir, it will increase the yield from the Lune valley catchment by over 17 mgd. This will augment supplies of the Tees Valley and Cleveland Water Board who serve an area of 270 sq. miles with a population of over 350,000 persons. Main consumers in the area are two new heavy chemical plants operated by Imperial Chemical Industries Ltd. and a number of steel mills.

■ THE MAIN SOURCE of supply for one of England's major centers of heavy industry in North Yorkshire consisted of two catchment areas which drained the rivers Lune and Balder — both tributaries of the river Tees. The total catchment area was about 30,000 acres. Here, three impounding reservoirs were constructed between 1890 and 1915. The gross reliable yield of these reservoirs was 20 mgd—just over one-half available for supply. Water was also taken from the River Tees at the rate of up to 13 mgd, depending on the flow of the river. However, in a very dry year, no more than 9 mil. gal. could be expected from this source.

Selset reservoir, when completed, will contain 2 bil. gal. compared with the 2,234 bil. gal. of the three existing reservoirs. Scheduled for com-

TUNNEL CONSTRUCTION, initially to serve for diverting the river and later to contain pipelines, required trucking approximately 7,000 tons of excavated material.

pletion in 1960, it will be 1¾ miles long and cover an area of 275 acres.

Description of project

The dam will consist of an earth embankment with a central puddle clay core. The top of the dam will be 130 ft above the river bed and will be 3,000 ft long. Volume of material in the bank will be 2.1 mil. cu yds. Below the embankment a cut-off trench was excavated to a depth of up to 140 ft, and filled with concrete to ensure no seepage of water below the dam. Flood water from the reservoir will overflow into a spillway channel on the north bank of the valley and will discharge into the existing pool above Selset weir. A 17 ft diameter tunnel driven through the south bank diverts the river during construction of the embankment. Later, this tunnel will contain pipelines taking water into Grassholme Reservoir or into the existing tunnel connecting Grassholme and Hury reservoirs.

Diversion tunnel

Construction started in June 1955. The first main job was the 17 ft diameter diversion tunnel. Concrete-lined, it is 1,415 ft long leading from the forebay upstream of the dam to the tailbay downstream. A cofferdam was then built across the valley, and the river was diverted through the tunnel in October 1956. During its construction, about 28,000 tons of material had to be dug out: about a quarter was carried by trucks for 700 yds, the remainder was tipped direct into spoil heaps.

Sub-core seal

Construction of the cut-off trench posed some interesting problems. Traversing the deepest section of the valley, it is filled with concrete to form a watertight cut-off under the core of the dam. To prevent percolation under the cut-off trench the ground was sealed: holes were drilled at 10 ft centers and up to 200 ft below the trench bottom. Cement grout was then pumped in at pressures up to 200 psi. The trench is 6 ft wide, 4,000 ft long and cut to a depth of up to 130 ft. Excavation of the 50,000 cu. yds of spoil was by hand: miners worked faces of 5 ft height, and excavated material was conveyed back by monorail skips to hoists placed in the trench at intervals of 100 ft. At ground level this material was dumped from the hoists through chutes and removed to spoil tips by dumptrucks. Trench supports consisted of steel sheets of 5 ft 8 inches by 13 inches by 5/32 inches, placed vertically and held in position by timbers and wedges. The bottom of the trench was sealed with a 12 inch layer of concrete in 50 ft sections. The trench was then filled to ground level again in 50 ft sections. Lifts of concrete were placed by concrete pumps fed from a large batching plant located on the north side of the valley. These pumps were able to work up to distances of 800 ft and to extend their range, remix pumps were sited at convenient positions. On the south side of the valley it became necessary to convey the concrete by Blaw Knox agitator mixer units mounted on trucks which discharged into the concrete pumps.

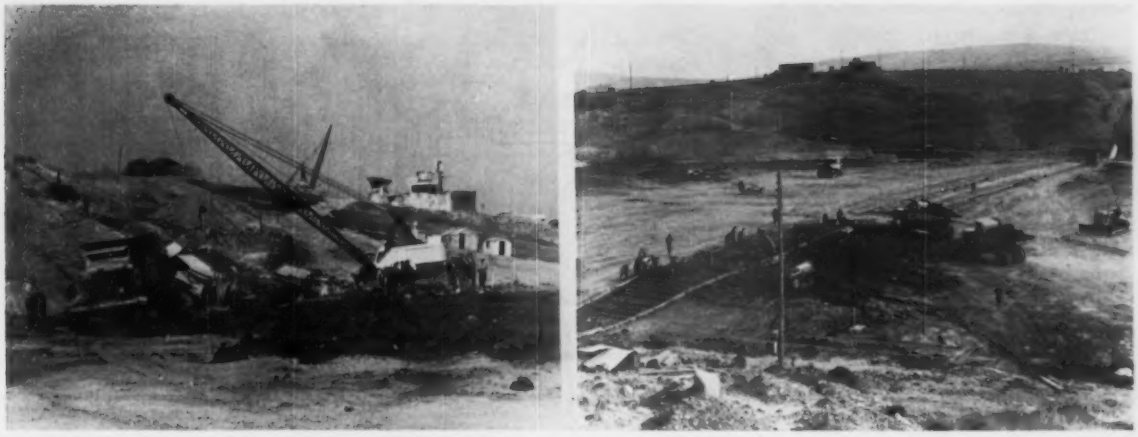
Clay core and fill foundation

Above ground level a clay core was hand placed in layers of 5 inch depth and 18 ft maximum width. Before the actual earth fill could be placed for the embankment, however, a soil mechanics investigation was carried out to determine the method to be adopted for consolidating part of the valley floor. This floor consisted of soft clay and gravel and could not have supported the dam. This was done by a vertical sand drainage system which caused the weight of the earth fill to squeeze the water out of the wet boulder clay, rendering it strong enough to support the dam.

General Features—Selset Reservoir

AUTHORITY:—TEES VALLEY WATER ACT, 1953

Reservoir	
Catchment Area	17,500 acres (27.3 sq. miles)
Rainfall	55.4 in. per annum
Av. flow	43 mgd (80 cfs)
Reservoir Area	275 acres
Reservoir Length	1¾ miles
Capacity	2900 mil gal
Top Water Level	1037 ft. O.D.
Yield	Yield of Lune catchment increased by 17.1 mgd
Compensation Water (Unchanged)	6.264 mgd (11.7 cfs) measured below Grassholme Dam
Dam	
Type	Earth embankment with concrete filled cut-off trench to impermeable strata, & puddle clay core
Length of Bank	3200 ft.
Height	130 ft.
Max. Depth of Water	117 ft.
Depth of Cut-Off Trench	130 ft.



CUT-OFF TRENCH construction to prevent percolation under the earthen dam required a trench 6 ft wide, 4,000 ft long and in some places up to 130 ft deep. Concrete was poured in 50 ft sections. At right, the clay core is shown being placed by hand. It was placed in layers of 5 inch depth and 18 ft maximum width.

Sand wells were installed, running vertically from the bottom of the soft boulder clay to the surface of the gravel overburden. A 12 inch thick layer of rubble was then placed on top of the gravel to ensure that water forced to the surface would be free to escape. The wells, 18 inches in diameter on a 10 ft grid, were unlined and filled with crushed whinstone. The longest release path for any water in the clay would thus be the distance to the nearest well, say 7 ft. It would rise up the well and flow out through the gravel or rubble.

Work on the first horizontal drainage blanket started on May 1, 1957. This operation involved moving 55,000 tons of limestone by dumptruck from a quarry near the north end of the dam. This entailed a maximum one-way journey of 1,400 yards to the upstream rubble toe of the dam located at the south end. The base blanket was spread from south to north. Additional layers, 9 inches thick, were laid at 15 ft intervals up to the full height of the embankment. By the end of the 1957 season the height of the dam fill was within 7 ft of the programmed height. A total of 350,000 cu yds had been placed in addition to 51,000 cu yds of crushed stone blankets.

Spillway

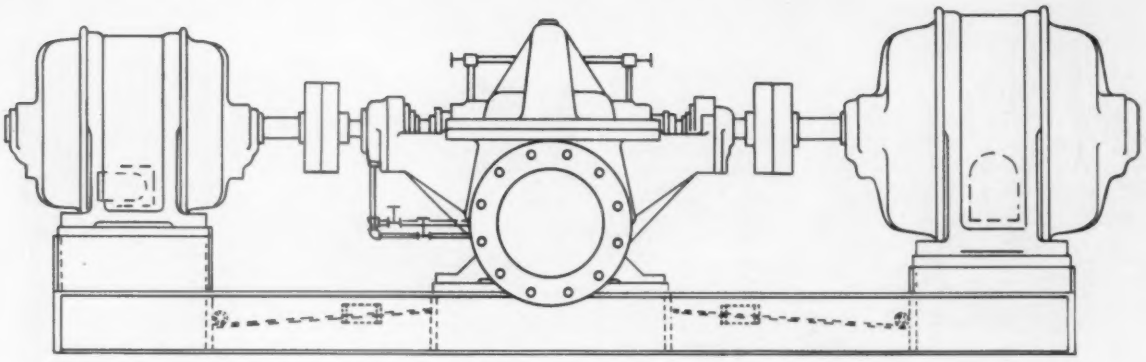
In 1958, the spillway channel was being constructed to take care of the overflow of water from the reservoir. It has a 325 ft long weir located near the north end of the dam and a stilling pool near the exit of the diversion tunnel. The channel is 33 ft 6 inches wide and up to 20 ft deep, and falls at a gradient varying between 1 in 35 and 1 in 5. Construction is in concrete with natural stone facing.

Impressions of the Brussel's Exposition

One can scarcely visit the Brussel's Exposition without bringing away some vivid impressions. Here are the thoughts of Prof. Robt. C. Merz, of Cal. Tech., presented with the hope that they will jog the memory of those of you who have been there, and be of interest to those of you who have not seen it.

"The ease with which a stranger can find the Exposition . . . the availability of tickets on the trams in lieu of fare . . . the simplicity of the official symbol . . . the thrill of seeing the United States from border to border through the eyes of eleven cameras projecting a technicolor travel film around 360 degrees, and the please of seeing the wonder in the faces of those watching . . . the unusually large Francis and Pelton wheels on display by no less than five countries . . . the delight of a genuine hot fudge sundae served in the soda fountain of the American Pavilion by a cute Cornell co-ed . . . the female attendants in the business sections of the men's rooms . . . the immense steel and glass structure of France . . . the elegance and richness of the United Kingdom exhibit . . . the magnificence of the Russian building, spoiled by too frequent souvenir and propaganda booths . . . the view from the top of the Atomium, and the long minutes of standing in line to get there . . . the colorful water stairs, with flow in both directions . . . the great personal satisfaction with the lovely American Pavilion, with the exception of the modernistic oils . . . the emphasis on commemorative postage stamps (so interesting to this collector) . . . the fine production of Carousel in the American theater . . . the sad toilet fixtures and my oh! my, that irritating t.p. . . . the courteous and helpful hostesses of all nations, garbed in smartly tailored maroon suits . . . the wave-making machine which was giving a man-made beach a terrific pounding . . . the wine cellar beneath the French building . . . the breathtaking Swiss fashions in a gorgeous glass-enclosed display . . . the complete chocolate factory producing cream-filled chocolate bars (the only inexpensive chocolate found in Northern Europe) . . . the admission charge extracted by the Russians to view Russian cinema (no thank you) . . . the wild animals (stuffed, of course) in their natural habitat, courtesy of the Belgian Congo . . . the modern and attractive kitchens of Finland . . . the nostalgic odor of freshly cut pine in the all-pine Norwegian building . . . the absence of Sweden . . . the disappointing international shopping center . . . the English version of a chicken salad sandwich: half fried chicken with potato salad and roll . . . the American Hot Dog . . . the five friendly flamingos . . . and the single snooty swan . . . the overall beauty and cleanliness of grounds and buildings . . . and, finally, the high caliber of the entire Exposition, coupled with virtual isolation of the customary amusement park.

—R.C.M.



SCHEMATIC illustrates arrangement of two two-speed motors for obtaining four-speed operation of . . .

Multi-Speed Pumps

by P. E. CARDILLO, Application Eng., Public Works Dept.
Worthington Corp., Harrison, N. J.

RESUME: With the present increasing rate of water consumption, it is becoming necessary to build larger facilities to accommodate more pumping equipment for the transmission of water from the source to the user. In larger cities this is a necessity when the demand approaches the maximum pumping capacity of the water works plant. However, this does not have to be done when multi-speed operation is used. This article is intended to illustrate the possibilities for multi-speed pump installation.

■ MOST ENGINEERS plan for increased water transmission by providing space for future pumping equipment in the design of water works facilities. A popular method in waterworks installations is to purchase duplicate pumps or pumps that will operate in parallel to give increased capacity as the water demand increases.

Parallel Operation

In Figure 1, the solid lines show the operation of two duplicate pumps which can operate either singly or in parallel against an assumed system head curve, depending on the water demand. The two broken lines represent performance of two additional duplicate pumps (for which space has been provided) installed to operate in parallel with the first two units. This, of course, is proper planning and in no way should be discouraged.

Increased Speed

It is also possible in some cases to obtain increased capacities and pressures by increasing the speed of the pumping equipment. When considering only electric motor drives, increased speeds may be obtained by replacing one-speed motors with those of higher speed, with multi-speed motors, magnetic drives, wound rotor motors, vari-drives and other methods.

Variable Speed

In some pumping systems it is often necessary to control the pumpage quite accurately. Wide variations in resulting heads and capacities require a variable speed driver. This can be accomplished either electrically or mechanically.

A mechanical method would be by use of a series of gears directly connected to a constant speed motor through a clutch. Gear losses which would reduce the overall efficiency of the pumping unit must be expected. Other mechanical methods of varying speed are by use of either engines or turbine drives. With these methods, driver efficiency is measured by fuel

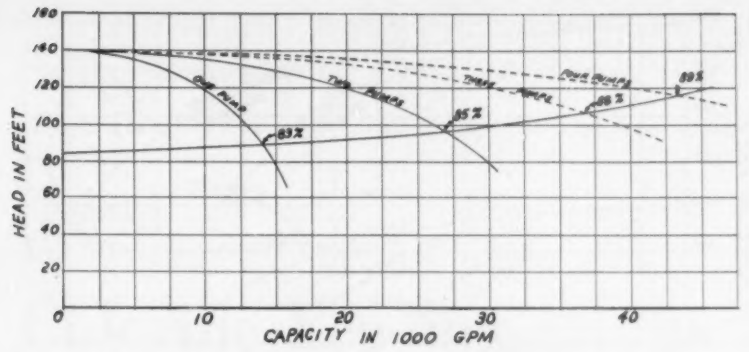


FIG. 1—PARALLEL OPERATION of two, three and four pumps on assumed system head.

consumption or steam flow, and reduction in overall efficiency is not so pronounced as with electrical means.

Speeds can be controlled electrically with the use of magnetic drives, wound rotor motors or vari-drives where variable flow is required. The variable drive must be selected for the highest horsepower and speed needed for maximum flow. Inherent to magnetic drives or wound rotor motors the efficiency drops approximately in proportion to the speed reduction. While vari-drives may be used for variable speeds up to approximately sixty horsepower, it must be remembered that the power input remains the same regardless of the speed. This may result in higher power cost per gallon of liquid pumped. It is natural to expect lower overall efficiency with these types of variable speed operation than if an engine or turbine were used.

Pumping Efficiency

High overall efficiency is not only desirable in water works but, in most cases, mandatory from the standpoint of economy. This exists at water works installations because the pumping equipment is operated continuously except for short periods of maintenance. Maximum efficiency is obtained by constant speed operation because demand drops force pumps to operate back on curve although the result is to merely put slightly more pressure in the distribution system. This pressure is dissipated by the demand which makes no difference at the pumping station since the equipment pumps only the demand required. The throttling is controlled by the user.

Referring again to Figure 1, it is noted that the maximum capacity with four pumps operating in parallel has been obtained. Normally, to obtain more capaicty, larger pumps must be furnished, or a new station is required if space has not been provided for more pumping equipment. In some cases, however, this is not necessary with the use of two-speed or multi-speed operation.

Two-Speed Operation

Figure 2 illustrates the results obtained with a two-speed motor driven pump (720 and 900 rpm) when operating against a system consisting entirely of friction head, with the solid lines representing a pump designed for the present conditions at 720 rpm. As the demand increases, the pump is operated without loss in efficiency at the higher speed of 900 rpm. This is shown by the dotted lines. The increase in capacity in this case is approximately 26 per cent.

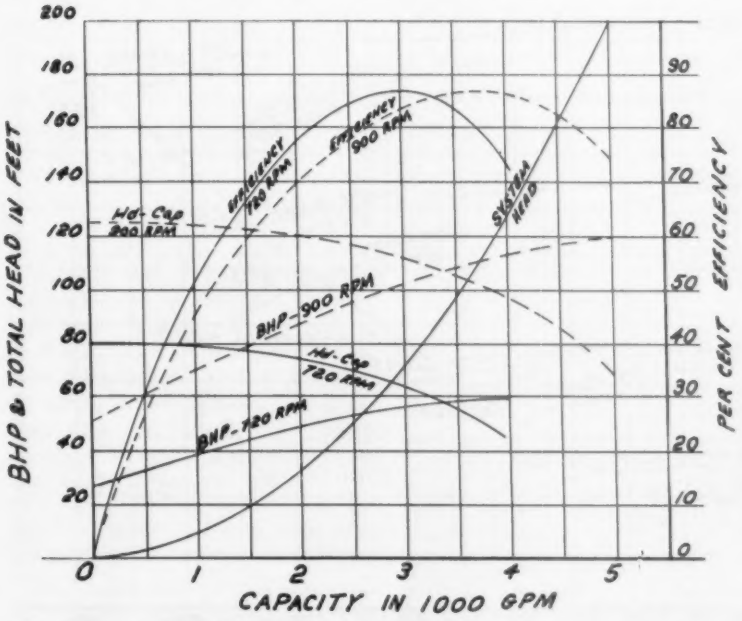


FIG. 2—TWO-SPEED OPERATION on system head of friction only shows about 26 per cent increase in capacity at higher speed without loss in efficiency.

Figure 3 represents an assumed system head curve with four pumps operating in parallel at the speeds of 720 and 900 rpm. With the four two-speed motor driven pumps operating in parallel, flexibility can be obtained up to the maximum capacity for these units. For a system of this nature, it must be remembered, however, that the pumps should be designed for the maximum average efficiency over the entire system head range, taking into consideration the range at which the demand is the greatest.

Four-Speed Operation

With a system consisting entirely of friction, as in Figure 2, it is pos-

sible to operate the pumping equipment at a lower speed of 600 rpm, or a higher speed of 1200 rpm, without any apparent loss in efficiency. In some cases it is also possible to utilize the same size pumps in parallel, with four-speed operation, consisting of double extended shafts on the pumps with two-speed motors at each end.

Figure 4 represents two and three pumps operating in parallel with four-speed operation against an assumed system head. Capacities up to approximately 88,000 gpm can be obtained with good efficiency, as shown in this figure. This method will give more flexibility over the system head range.

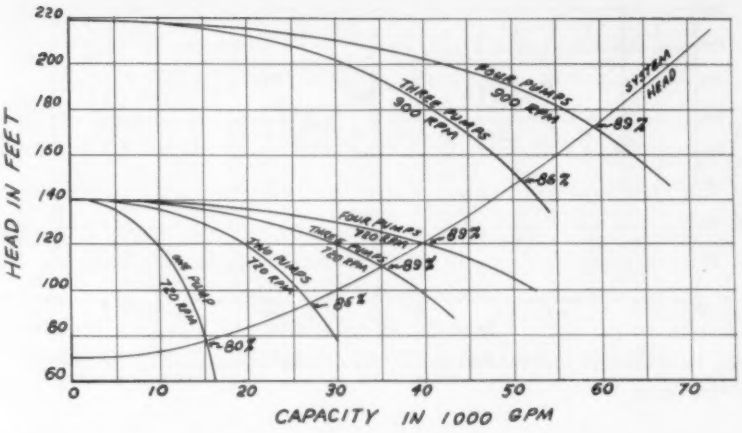


FIG. 3—PARALLEL AND TWO-SPEED OPERATION of four pumps against assumed system head.

Economics

Water works installation expenditures have doubled in the past ten years due to continuous rise in power cost, materials, equipment and labor. It is likely that this trend will continue. With the use of identical pumps where possible, with provisions for obtaining the higher future demand in capacity by increased speed, future expenditures can be minimized. Spare parts, as well as maintenance costs, are reduced to a minimum.

It must be borne in mind that each public water supply system is different, and pumping equipment is affected by different capacities, suction conditions, static heads and friction heads. Therefore, all factors involved must be known and applied when making two, three or four speed pump applications to determine the most efficient and economical approach. Planning for expansion on the basis of complete operational data and using multi-speed units can save water works installations large amounts of money.

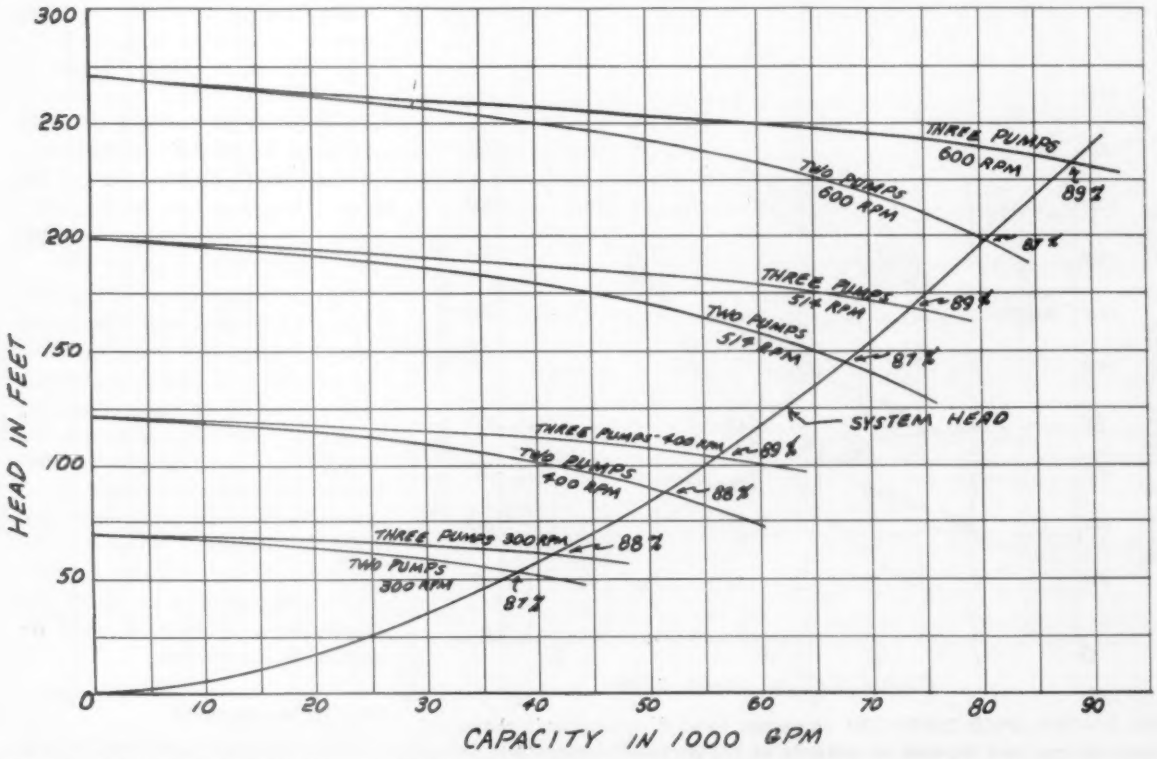


FIG. 4—PARALLEL AND FOUR-SPEED OPERATION of two and three pumps against assumed system head.

CHLORINATION GUIDE

This fifth of a series of articles on chlorination practices discusses . . .

Chlorine Feeding Equipment

by EDMUND J. LAUBUSCH, Sanitary Engineer
The Chlorine Institute*, New York, N. Y.

AUTHOR'S NOTE: The purpose of this series of articles is to review briefly, the fundamental principles of the chlorination processes, especially as they relate to conventional water and wastewater treatment practices; to point out some of the principal hazards and flagrant abuses that are associated with chlorine use, and various means by which these can be minimized or corrected; and to delineate, in a practical way, safe and effective handling techniques using equipment evolved from the cautious but rapid advancement of the science and art of chlorination.

In this article, attention is directed to the principles fundamental to the safe, accurate, and reliable application of chlorine to water and wastewater treatment processes, and to the consideration of the features of a number of proprietary chlorine feed devices by which these objectives are accomplished. Discussion of hypochlorite feed equipment, is outside the scope of this article and will be discussed later.

■ IT WAS POINTED out in earlier sections of this series that sanitary applications of chlorine must be carefully controlled in order to accomplish the treatment objective. Moreover, where disinfection is necessary to insure water potability and, in some cases, to comply with stream quality criteria, the process must be continuous. It also was indicated that large quantities of chlorine can be safely confined in heavy-duty containers to facilitate shipment and handling, and that chlorine can be withdrawn from these containers in either a liquid or gaseous state.

Chlorine Feeders

Chlorine dispensing equipment is designed to control and measure chlorine in the gaseous state and to apply it either as a gas or as an aqueous chlorine solution. Gaseous feed is predicated on these factors: the practice lends itself to accurate flow regulation, either manual or automatic; gas may be metered with variable area or fixed orifice type flow meters (with or without recording instruments); and, chlorine gas can be diffused into water.

Basically, there are two types of equipment employed for applying chlorine. *Direct-feed* equipment involves metering of dry chlorine gas and conducting it under necessary pressure conditions to the water or waste being chlorinated. *Solution-feed* equipment involves metering of dry chlorine gas under a vacuum and dissolving it in a small amount of water so that a high-strength solution is applied. In either case, the chlorine is dispensed to the feed equipment from an upright cylinder, the top (gas) outlet valve of a horizontal ton container, the gas valve of a single unit tank car, the outlet of a chlorine evaporator, or a header valve in the chlorine gas piping system.

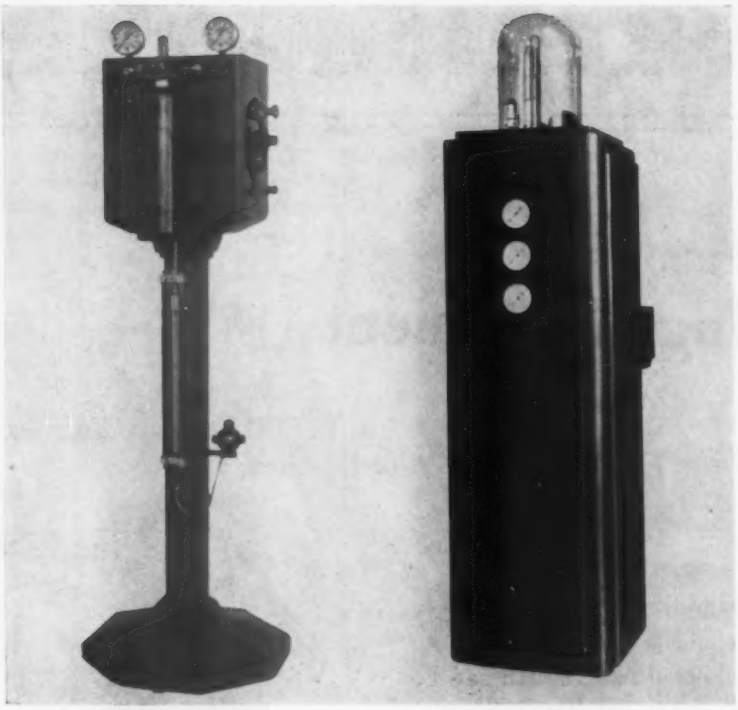
The operation of direct or solution-feed equipment is based on the common principle of regulating flow by establishing a pressure relationship on the upstream and downstream sides of a constant or variable orifice in the chlorine gas flow line. Means are provided for controlling the feed rate either by varying the pressure differential across a fixed orifice (variable differential units), or by varying the orifice size (constant differential units).

Direct-Feed (Mechanical Diaphragm)

Metering components of direct-

* The Institute and its members make no guarantee of results and assume no liability, either jointly or severally, in connection with the information herein contained or the safety suggestions herein made.

** See *Wat. & Sew. Wks.*—Part I, Vol. 105, p. 411; Part II, Vol. 105, p. 509; Part III, Vol. 106, p. 71; Part IV, Vol. 106, p. 71.



Courtesy Wallace & Tiernan, Inc.

FIG. V-1. DIRECT feed, mechanical diaphragm, pressure type manual control chlorinator. Modified units are available for automatic proportional control.

FIG. V-2. SOLUTION feed, water diaphragm, vacuum-type, manual control chlorinator. Intermittent start-stop control is possible by auxiliary devices to interrupt injector water supply.

feed equipment (See Fig. V-1) may be either the rotameter (variable area) or manometer (pressure differential) types, with provision for pressure compensation to insure metering accuracy. Gas passes through a pressure compensating valve, and then to a back pressure regulating and check valve designed to maintain a constant downstream metering pressure and to prevent liquid from entering the chlorine line in event of shut down or the development of excessive back pressures at the point of application. The gas is applied directly through some type of diffusor into the water or waste to be treated.

Since chlorine gas is only slightly soluble in water, however, (approximately 35 gal are required to dissolve one lb of gas at 68°F.) direct feed of chlorine gas under pressure into the water or waste system to be treated limits the rates at which gas can be fed. Undissolved chlorine gas in a moist environment presents corrosive conditions of serious magnitude. Because of these and other technical limitations, and for safety reasons, chief among which is the fact that direct-feed equipment is operated under pressure, the use of solution-feed, vacuum type equipment is the more common and preferred practice.

The practice of dispensing chlorine gas from the source to the flow to be chlorinated without the use of either direct or solution-feed equipment is unsafe and should not be permitted.

Solution-Feed (Vacuum)

Solution-feed equipment provides for the concentration of chlorine in a small volume of water under pressure, and the application of the solution against pressure to the water or waste being chlorinated. Chlorine gas is maintained under vacuum throughout the metering apparatus.

Contemporary units usually are equipped with a differential-type or variable area flow meter to guide the operator in establishing a desired feed rate; a compensating vacuum regulating valve to maintain a constant upstream pressure and a back pressure valve to maintain a constant downstream condition; a vacuum-creating injector or eductor in which gas also may be mixed with a small quantity of water preliminary to the point of application; and/or other modifications in addition to those devices incorporated primarily to protect the apparatus and operating personnel. The opening of the chlorine inlet valve is governed directly or indirectly by vacuum induced in the system. Thus, if the injector fails, if there is a break in the system, or if the discharge line becomes clogged, the chlorine feed is instantly stopped.

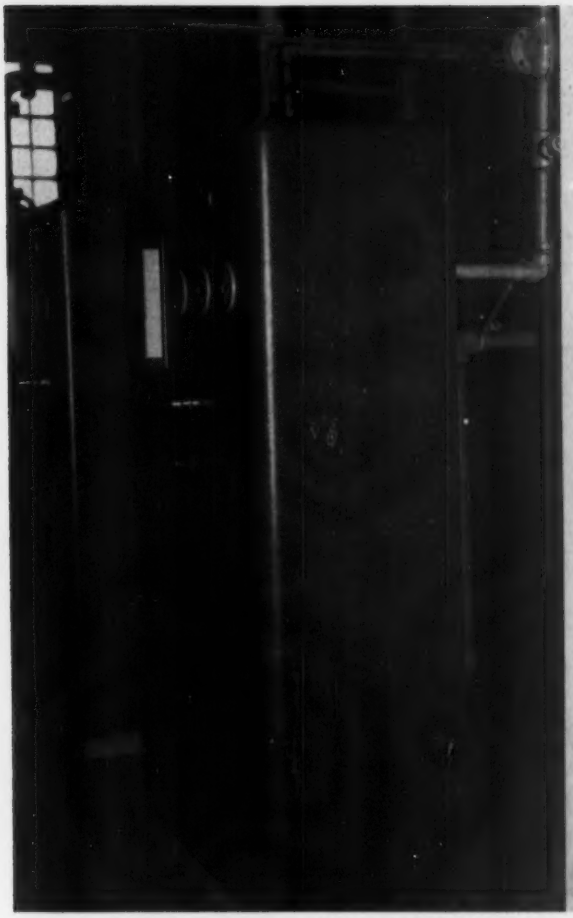
To protect operating personnel and equipment in event of a gas flow during shut down, air relief discharging to atmosphere is provided. In addition, a vacuum breaker, also connected to an atmospheric vent, is provided to allow air to enter the system whenever the vacuum exceeds a preset amount. Therefore, should an excessive vacuum be created due to the loss of chlorine supply or the absorption of the gas in the system during shutdown, the vacuum breaker will prevent the possibility of water being drawn into the apparatus. These vents, constituting important safety devices, should be kept dry and clear and should be inspected regularly to insure proper functioning at all times.

Bell Jar Chlorinators

Today, the two most used types of feeders often are referred to as mechanical diaphragm feeders and water diaphragm or bell jar chlorinators. Bell jar chlorinators, such as those marketed by Wallace & Tiernan Inc. since about 1915, are characterized by a glass bell jar which encloses the chlorine pressure-reducing valve, metering orifice, scale, and vacuum relief float, and which allows the operator to note the presence of vacuum within the system. A water seal maintained by an auxiliary water line and the operating vacuum confines chlorine within the bell jar. An injector maintains a vacuum in the chlorinator and chlorine is fed at a rate dependent on the size of the metering orifice and amount of vacuum maintained within the equipment.

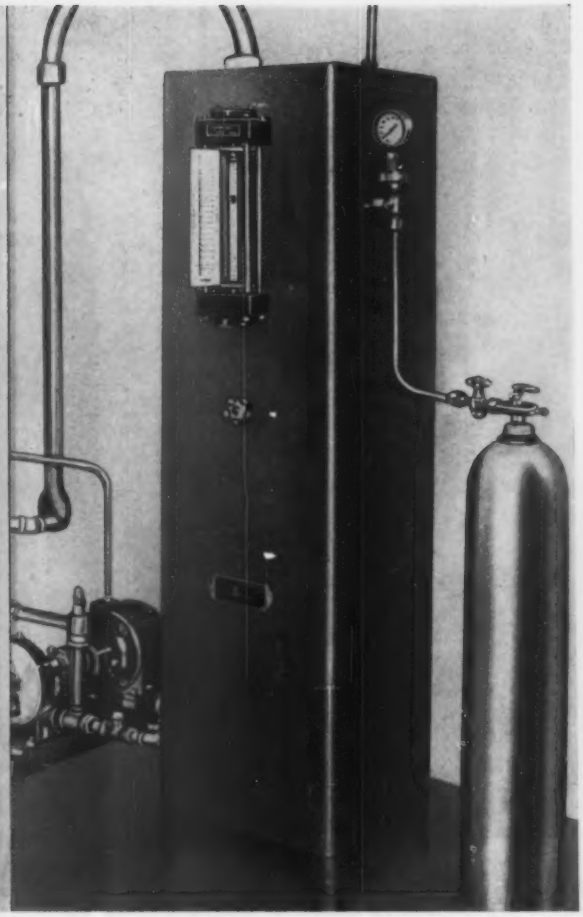
In W&T Visible Vacuum Chlorinators* (See Fig. V-2) the chlorine pressure reducing valve (which controls the chlorine gas supply entering the bell jar) is actuated by a float on the surface of the water diaphragm under the bell-jar, and maintains a

* Product of Wallace & Tiernan Inc., Belleville 9, N. J.



Courtesy Builders-Providence, Inc.

FIG. V-3. MECHANICAL diaphragm Chlorinizer (8000 lb/24 hr) incorporating sightflo indicator, visible vacuum bell-jar, and spring, with loaded chlorine control valve for manual or automatic chlorine feed control.



Courtesy of Everson Mfg. Corp.

FIG. V-4. SOLUTION feed SterElator operating on high vacuum for manual of automatic chlorine feed control. Maximum capacity of unit shown is 1000 lb/24 hr.

constant partial vacuum in the bell jar at the upstream side of the orifice. On the downstream side of the orifice the injector vacuum is controlled by the meter vacuum control device which maintains a constant vacuum for any given setting. This control device varies with different models of chlorinators: in some the proper vacuum is maintained by satisfying the excess vacuum with make-up water, while in others the injector vacuum is throttled by a vacuum control valve. Chlorine gas flows to the injector where it is mixed with water and distributed through a rubber hose or other chlorine-resistant conduit to the point of application.

Change in feed rate is accomplished manually by adjusting the meter vacuum control device which varies the downstream vacuum on the metering orifice, or it can be accomplished automatically by auxiliary equipment. The feed rate, usually calibrated in lb of chlorine per 24 hr, is read directly on a monameter and scale assembly located on the fixed orifice.

Mechanical Diaphragm Feeders

Mechanical diaphragm feeders are characterized by the use of mechanical diaphragms for operation of the regulating valves, and a bell-jar, vacuum gage, or rotameter for indicating proper vacuum within the system. The earliest chlorinators built were of this type.

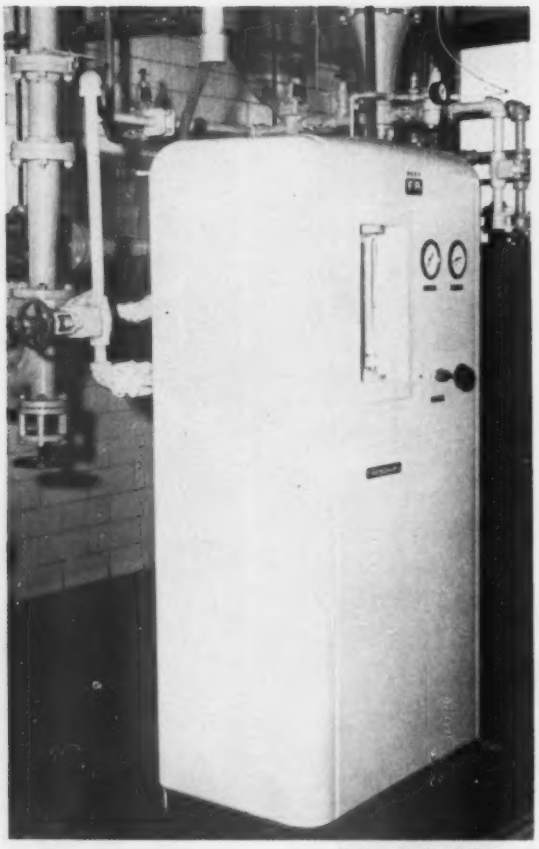
Rotameters; spring-opposed, diaphragm-operated chlorine pressure regulators upstream from the rotameter; and diaphragm-operated vacuum regulators downstream from the rotameter and safety shut-offs characterize the equipment available from many suppliers in the sanitary field. Others market units which are combinations between the mechanical diaphragm and visible vacuum units incorporating the bell-jar as well as the rotameter and the spring-opposed, diaphragm-operated vacuum regulator safety shut-off.

Details of these chlorinators are discussed below*.

*B-I-F Chlorinizers.*** These units (see Fig. V-3), available in capacities up to 8000 lb/24 hr., utilize an injector-induced vacuum to maintain a continuous flow of dry chlorine gas through a fixed metering orifice, rotameter and bell-jar (visible from the rear). Operation depends on keep-

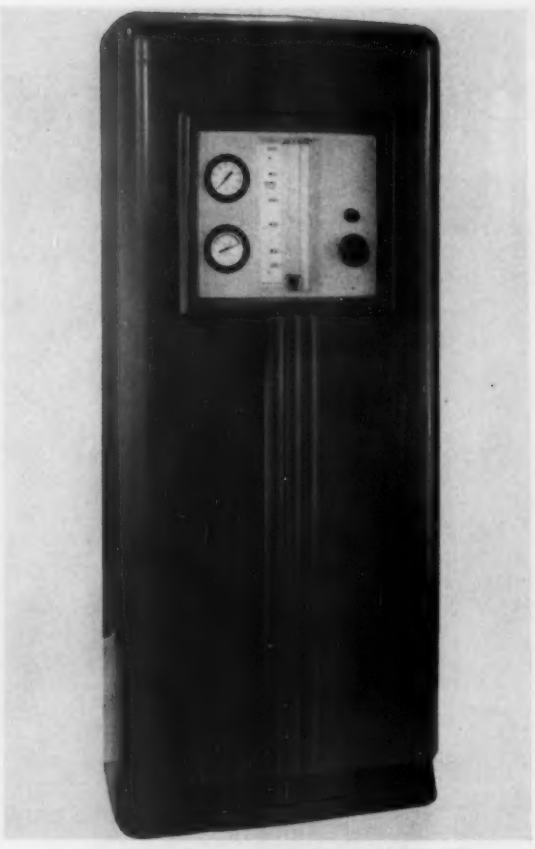
* Products are listed by companies and are presented alphabetically with no intent to establish relative popularity or quality relationships for sanitary uses.

** Product of Builders-Providence, Inc., Div. of B-I-F Industries, Inc., Providence, R. I.



Courtesy Fischer & Porter Co.

FIG. V-5. MECHANICAL diaphragm chlorinator, high capacity solution feed for manual or automatic chlorine feed control.



Courtesy Wallace & Tiernan, Inc.

FIG. V-6. V-NOTCH variable orifice mechanical diaphragm chlorinator adaptable to any type of automatic control.

ing downstream conditions constant and controlling conditions upstream of a metering orifice in the flow line. Chlorine gas enters the pressure-reducing control valve and the metering orifice, and, after passing through the rotameter and bell-jar, it is drawn through the injector where an aqueous chlorine solution is formed.

The control valve consists of two chambers separated by a flexible, tantalum diaphragm. The upper chamber, containing a needle valve upon which feed rate control depends, reduces the chlorine gas pressure to a partial vacuum. The lower chamber, providing the means by which the needle valve is adjusted, contains water under pressure. The feed rate is determined by the reduced and compensated pressure in the upper chamber imposed by a manual or automatic change of water pressure in the lower chamber.

The bell-jar encloses the metered gas and contains a float-operated vacuum release and air vent and a suction standpipe which limits and maintains the vacuum constant. The unit is suspended on a rod connected to the control valve in such a manner that chlorine flow through the metering orifice is stopped in event of vacuum loss. The calibrated rotameter shows dosage rate and provides a means of observing chlorine gas flow.

*Everson SterElators.**** In these units (see Fig. V-4), available in capacities up to 8000 lb/24 hr., chlorine gas under pressure enters the chlorine gas regulator and automatic shut-off valve where it is reduced and maintained at a constant flow regardless of changes in chlorine cylinder pressure. The gas flows under vacuum through a gas throttling valve to the metering component, a visible, variable-area calibrated rotameter, and thence to a vacuum tower for delivery to the suction side of the vacuum producing injector.

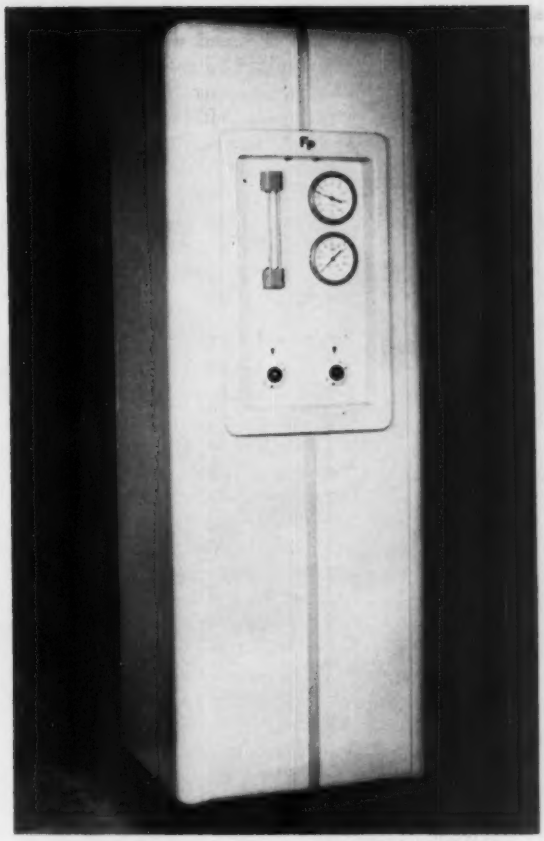
The gas is removed from the upper end of the vacuum tower through a suction draft tube having a variable area, inverted V-slot in it; enough water is also removed to satisfy the remaining demand of injector suction. The open end or lower portion of the vacuum tower is immersed in a float-controlled, constant level water reservoir which serves as a water seal between metered chlorine gas and the atmosphere.

In addition to the chlorine gas pressure regulator and automatic shut-off valve, a vent to the outside atmosphere is provided in conjunction with a hydraulic vacuum breaker to release the vacuum within the chlorinating unit during shut-off periods.

Fischer & Porter Chlorinator.† In this solution-feed, mechanical diaphragm unit (see Fig. V-5), the functions of the vacuum regulator, differential pressure regulator pressure relief and vacuum braker are incorporated into a single assembly.

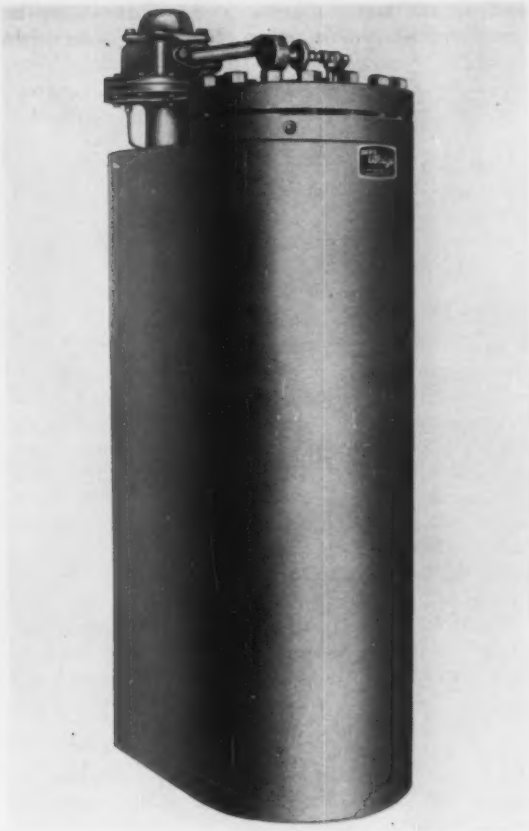
*** Product of Everson Manufacturing Corp., Chicago, Ill.

† Product of Fischer & Porter Co., Hatboro, Pa.



Courtesy Fischer & Porter Co.

FIG. V-7a. CHLORINE evaporator unit shows water level, temperature gages and control switch thermostats.



Courtesy Builders-Providence, Inc.

FIG. V-7b. CHLORINE vaporizer with control devices and gages on top of unit.

Water under pressure flowing through the ejector creates a vacuum extending to the vacuum regulator where the pressure of chlorine gas is reduced. A constant flow of gas, metered by a rotameter at this reduced pressure, is obtained by adjusting the chlorine rate setting valve which is in parallel with the differential pressure regulator. The differential pressure regulator throttles the flow of gas to maintain a differential pressure across the rate valve. Gas flows to the ejector where it is mixed with water just prior to discharge.

The chlorine regulator assembly contains a vacuum shut-off valve, a pressure relief valve, vacuum breaker and atmospheric vent. The ejector block contains a backflow check valve (to provide protection against positive pressure in the chlorinator in addition to that afforded by the pressure relief valve), two ball check valves, and a drain connection to prevent flooding.

The basic instruments are available in capacities up to 8000 lb/hr. and can be equipped with various automatic features as later described. In addition, the company markets a 0.1-1000 lb/24 hr. portable unit.

*"V-Notch" Chlorinator.*** In addition to the visible vacuum units discussed, W & T markets a solution feed, mechanical diaphragm type unit (see Fig. V-6) in which the flow of chlorine gas is adjusted by manually or automatically varying the area of a "V-notch" orifice while maintaining a constant differential across the orifice. Units with capacities up to 8000 lb/24 hr currently are available.

The inlet diaphragm-operated, chlorine pressure-reducing valve is spring-loaded so that the normal operating vacuum must be present before chlorine can enter the equipment and so that the supply is shut off in event of a loss of operating vacuum such as would occur if the injector water supply failed. Chlorine gas flows through a variable orifice and passes through a vacuum differential valve (which maintains the constant pressure differential across the orifice) and then to the injector.

Auxiliary make-up water is not required for chlorinator operation; only the injector, which usually is located outside the chlorinator cabinet, requires a water supply. In some models a ball-check is provided to prevent back flow of water from the chlorinator, but a drain relief valve also is provided in the event that abnormal conditions permit water to enter the chlorinator. Most models, however, use a spring-loaded diaphragm-operated check valve on the suction side of the injector and do not require drains of any kind.

Equipment Inventory and Maintenance

The use of chlorine in connection with water and sewage treatment might be indicated for various reasons, the most important of which is, of course, to protect the public health. For this purpose, chlorination processes must be continuous. Thus, where this is the objective, it usually

** Product of Wallace & Tiernan, Inc., Belleville, N. J.

is considered that standby chlorinators should be available. This applies not only to water treatment facilities employing disinfection but also to those sewage and industrial waste treatment facilities where effluent chlorination is required for any purpose by public health authorities concerned.

At plants normally requiring a single chlorinator, it is considered good practice to provide one additional chlorinator of equal capacity for use in an emergency. At plants normally requiring two or more chlorinators, a duplicate of the largest unit should be provided, i.e., one or more chlorinator than is required for normal maximum demand.[1]

Of equal importance to the provision of standby equipment is the regular, frequent inspection of operation and servicing of all chlorinators, including standby units. Spare parts as indicated by experience and recommended by the equipment manufacturer should be available; this is especially important where standby equipment is not provided at the site.

Close attention should be paid to all portions of the chlorine piping system and feeding equipment for evidence of gas leaks. (See Part IV.) Inspection should be made of all threaded connections and valves and any leaks should be promptly stopped. Packing glands tend to dry out and should be replaced at regular intervals.

In servicing chlorinators especial attention should be given to the chlorine pressure-reducing valve, and care must be exercised to avoid damaging the valve stem and seat in removing excess scale formation. Bell-jar surfaces should be kept clean; moreover, it is good practice to remove chlorine from the bell-jar regularly as this chlorine takes on some moisture from the water seal and is corrosive. This is accomplished by closing the chlorine supply valve and continuing injector operation until all chlorine is removed.

Chlorine residue should be removed from hard rubber floats and other affected portions of the feeding equipment; frequently this can be accomplished by scraping. Sharp instruments and abrasives should be used carefully to prevent damage to the equipment, and inhalation of the dusty residue should be avoided. Where the use of a solvent, such as methanol or carbon tetrachloride is indicated, parts should be pre-washed to remove water-soluble material; immersed gently in the solvent, using care to avoid breathing any fumes released; and, they should be thoroughly rinsed and air-dried before returning them to service.[2]

The formation of chlorine hydrate or "chlorine ice" in some feeders, resulting from high concentrations of chlorine and moisture at reduced pressure and at temperatures below 49.2°F. may interfere with metering accuracy or adequate vacuum relief, and may cause shutdown of the equipment. The safest means of controlling this problem is to warm the make-up water.

All components exposed to moist chlorine should be constructed of corrosion-resistant materials. Metal cabinets and other metal surfaces can be protected against corrosion by moist chlorine by painting with a thin coating of gasoline and vaseline. The light vaseline film remaining after the gasoline evaporates affords satisfactory protection.[2]

Automatic Control

Auxiliary equipment which enables automatic control of chlorine dosage has been developed considerably in recent years. Accessories are available which will automatically vary the feed proportional to the flow and quality of the liquid chlorinated, or will affect intermittent chlorine dosage where desired. These and other devices designed to simplify and improve chlorination practices are discussed in a later section.

Chlorine Evaporators

As noted, conventional chlorinators are designed to control, measure and feed chlorine in the gaseous state. Where adequate gas discharge cannot be obtained without complex and potentially hazardous manifolding systems, evacuation of chlorine from the container (usually ton units and tank cars) in the liquid state may be necessary. In general, where the chlorine requirements exceed about 2000-3000 lb/24 hr the use of an evaporator (vaporizer or heat exchanger) is indicated.

Most models, available in capacities up to about 8000 lb/24 hr maximum, include a sealed chlorine pressure chamber immersed heaters that are thermostatically controlled to maintain constant temperature and to ensure a superheated chlorine gas supply. (See Fig. V-7.) Other models are steam-heated or heated with water piped to the unit. All contain suitable safety features and optional accessories that ensure safe and efficient operation.

Relatively little maintenance of evaporators, other than for scale and corrosion control, usually is necessary. Cathodic protection of the chlorine pressure chamber may be helpful where indicated.

Equipment Housing

As discussed in Part III of this series, it is preferable to locate chlorinators and appurtenances in a suitable enclosure separate from the chlorine storage room. Whenever this is not possible or where any temperature differential might exist, chlorine gas lines to the chlorinator should not be allowed to drop below the supply container temperature or reliquefaction might occur. Liquid chlorine lines should be kept cool and protected from excessive heat when necessary to prevent vaporization of chlorine.

In selecting the location of chlorine feeders, accessibility is an important consideration. They should be relatively close to the point of process application and convenient to truck or railroad access for safe container handling and storage. A water supply in sufficient quantity and at sufficient pressure should be available where solution-feed equipment is used; booster pumps may be necessary whenever high back-pressure conditions exist and sufficient supply is not available to insure proper operation of chlorinator injectors. Suitable drains should be available. Power must be available for light, heat, ventilators, pumps and evaporators or other electrical actuating or control equipment. Standby power sources should be provided where necessary to ensure continuity of chlorination processes.

Acknowledgment

The author acknowledges with appreciation the generous technical assistance received from representatives of all the companies whose equipment is discussed.

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(1) Joint Committee Report. Recommended Procedures in the Use of Chlorine at Water and Sewage Plants. *J.A.W.W.A.*, 45:10 (Oct. 1953)

(2) Langworthy, V. W. Principles of Handling Chlorine. *Water & Sewage Wks.* R & D Edition (May 1954)

A qualitative analysis demonstrates the ability of . . .

Fatty Oils *to remove taste and odor*

by L. N. KLINGE, M. TELE, M. J. WAALE and
H. I. WATERMAN, Technological Univ., Delft, Holland

EDITOR'S NOTE: In a previously published article Dr. H. I. Waterman in collaboration with his assistants described a method of using fatty oils for removing taste and odor from water supplies.

In this article a qualitative analysis for investigating the ability of the fatty oils to absorb recognized taste and odor causing contaminants is described. Groups of organic compounds in the same family with the phenols and marcaptans were used as model contaminants. The ability of the oils to absorb these contaminants was determined by color development type analysis. Ground nut, rapeseed, linseed, olive and ricinus oil all proved to be satisfactory absorbent oils.

■ BOELHOUWER, SYDERIUS, TELS AND WATERMAN[1] have shown that certain odoriferous compounds can be removed from surface waters by dispersing less than 0.1 per cent by weight of a fatty oil in the water. The oil, that contains the contaminants, is separated from the water by flocculation of ferric hydroxide and filtration of the oil-bearing floc.

Waterman and Syderius[6] indicated that the oil is best added as an emulsion. The oil is for instance dispersed in part of the water to be treated. If necessary a suitable emulsifying agent may be used.

Comparatively little is known about the nature of the compounds that give a disagreeable taste and odor to surface waters. The number of organic substances occurring in surface waters is very large. The concentrations of the contaminants usually are low. At present it is possible only to separate the contaminants into certain groups.[2] This lack of knowledge makes it difficult to study the present purification methods by experiments on naturally occurring surface waters. The authors, therefore, used artifically contaminated waters prepared by adding known amounts of pure model compounds to clean water. The model contaminants were chosen from groups of organic substances that are known to occur in surface waters and that spoil the taste and odor of water when present in small amounts. The phenols[3] and the mercaptans belong to these groups.

A new test method was developed to determine qualitatively whether a particular oil is able to absorb a certain contaminant from water. It is hoped that this test will also be found useful outside the limited field of water purification. The test is described as follows:

Experimental

The aim of the test is to visualize the purification process. A phenolic substance, p-tert. butylphenol, was chosen as a model contaminant. This compound couples with diazotated sulfanilic acid to form a red azo dye.[5]

Two per cent by weight of agar is placed in distilled water, soaked and heated. After the agar dissolves, 50 to 100 mg/L of p-tert. butylphenol is added and the fluid stirred rapidly. The fluid is poured through a sieve into a Petri dish (diameter 6 inches). The dish is covered and cooled until the agar sets. Six holes are drilled in the agar plate, five along the circumference of the plate and one in the middle. Mineral or fatty oils, or fluid fatty acids are poured into the holes along the circumference. The hole in the middle remains empty. This hole serves as a blank. After several hours the plate is developed by spraying over it a freshly prepared solution of 100 mg of diazotated sulfanilic acid in 20 ml of a 10 per cent aqueous sodium carbonate solution. An atomizer is used. The plate is colored red in those places, where the p-tert. butylphenol concentration is higher than 5 mg/L. When an oil, inside a hole, absorbs p-tert. butylphenol from the plate a discolored zone is found around this hole.

Figure 1 illustrates the application of this test to five oils. All oils tested on the agar plate shown were able to absorb p-tert. butylphenol. No discoloration is noticed in the middle of the plate.

The oils do not interfere with the coupling reaction by penetrating into the agar gel or covering the plate. This was shown by dissolving the dye Sudan IV in the oils. This dye is insoluble in water. The colored oils

were placed in holes in agar plates. The oils did not penetrate into the gel or cover the plates.

Tests Using Iso-amylmercaptan

Tests, in which iso-amylmercaptan was used as a model contaminant, were carried out in the same manner. The iso-amylmercaptan concentration in the agar solutions was 1000 mg/L. A reaction between mercaptans and a-nitroso-β-naphthol, described by Kutzelnigg,[4] was used for development. After the oils had remained in contact with the agar gel for some hours a 0.01 M solution of a-nitroso-β-naphthol in 96 per cent alcohol was poured over the plate. Excess reagent was removed from the plate. In about 16 hrs the color had fully developed. The oils were carefully removed before development to prevent them from absorbing the dye formed. Corn oil proved to be able to absorb iso-amylmercaptan.

A Modified Test

Agar plates have the disadvantage in that a doubtful result is easily misjudged. The edges of a hole are more transparent than the parts of the plate that are farther away from the hole. For this reason one may wrongly think the edge of a hole is lighter in color than the rest of the plate. Consequently, a modified test was used in doubtful cases. An agar solution that contained the model contaminant was poured out over a filter paper and cooled till the agar had almost set. A second, smaller piece of filter paper was impregnated with the oil to be tested and placed on a glass plate. The first, a larger piece of filter paper, bearing the almost solid agar solution was placed upon the second, a smaller paper, that contained the oil, so as to cover it completely. After a few hours a developing fluid was sprayed over the agar surface. The part of the agar over the small paper which contained the oil was discolored when the oil was able to absorb the model contaminant. This type of test is shown in figure 2. Here the model compound was again p-tert. butylphenol (10 mg/L in a 2 per cent agar solution). Development was carried out as described above.

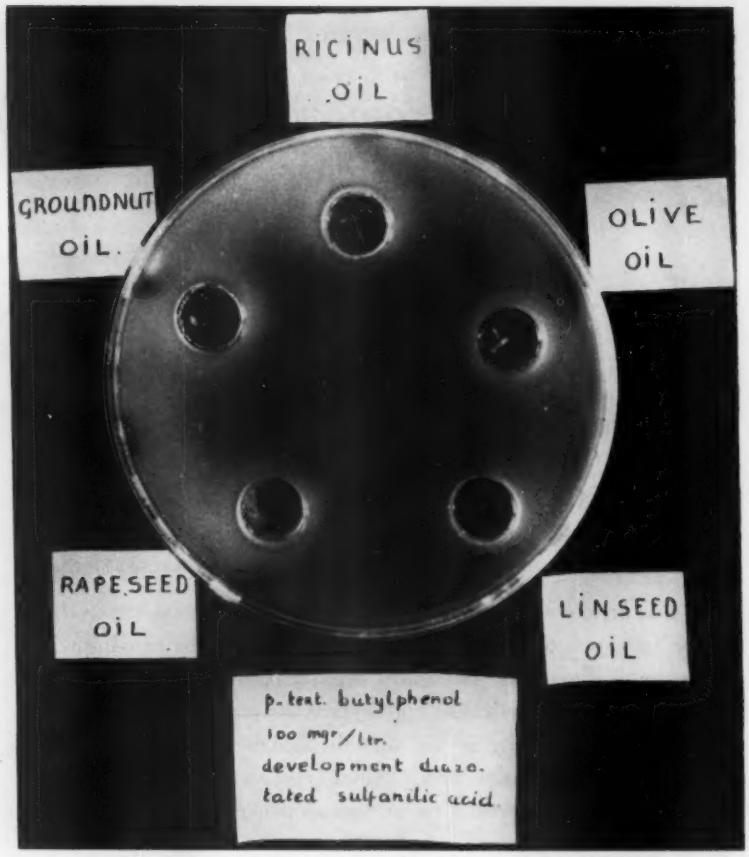

FIG. 1. FIVE OILS are capable of absorbing p-tert. butyl phenol from the zone of agar around them.

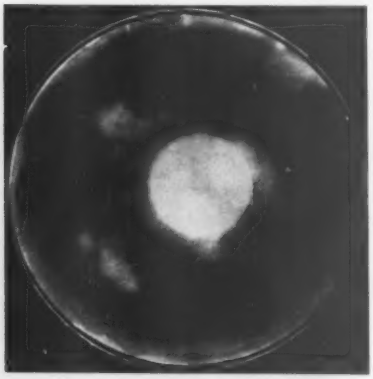

FIG. 2. OIL containing filter paper absorbed contanimant from agar to produce discolored spot on plate.

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Bill says all the pumps are out on the job . . .

What Price . . . What Factors . . . How are engineers to make . . .

Stream Flow Measurements *authentic?*

by RAPHAEL G. KAZMANN,
Consulting Engineer, Stuttgart, Kansas

EDITOR'S NOTE: Technological advance has been responsible for the decline and fall of a number of engineering methods and practices. Now, a question arises concerning the validity of the objective approach in making hydrologic measurements. The handbook, designed as a source of condensed and readily available up-to-date information, is no longer capable of presenting all the factors which must be considered in making sound hydrological evaluations. Today's studies must include subjective information which takes into consideration all those activities competing for use of the available water resource. Rain making and weather control, for instance, question any quantity calculation of the expected water resource if based on runoff data. What factor is applied for man-made droughts? Under political stream control, does irrigation, navigation, recreation, power or water supply become the priority user? What guesstimate can the engineer apply to present and future demands of water users. Read what a consultant engineer has to say, then form your opinion.

■ IN THE WORLD of civil engineering a good handbook is as essential to the engineer as Gray's Anatomy is to the physician. Yet the rapid advance of technology has surrounded even the most recent of handbooks with an air of unreality. There is a vague feeling of doubt, or uncertainty, associated with applying the techniques detailed in the text.

The Runoff Formula

For example, all water studies, whether water supply, drainage, flood-control, storage, or sewage dilution, are based on the runoff from an area. Much time and effort has been expended to determine general relationships to aid the engineer in making essential preliminary estimates. Passages representative of the material on runoff found in texts although correct are academic (see Box).

The engineer who follows all procedures faithfully and conscientiously has a remarkably good chance of ending up with no water at all regardless of how much runoff he figures is available. Nowhere in the text is there any indication that the first consideration must be *Is anyone already taking water from this stream?* The handbook operates on the unstated assumption that the watershed is virgin and that the proposed development will be the first one. This is seldom true now, and will be increasingly unlikely in the future.

A User?

If someone is using or controlling the runoff at a point upstream from the proposed development then the *plans* of the upstream user or the legal rights of the man downstream, although not measurable with a current-meter or rainfall gage, are just as much a part of the pertinent hydrologic data as are the USGS records. But it is not sufficient to consider the effects of the plans of water *users*. Hydrologic data has become politicalized, now that governmental agencies control many of our rivers. And the published plans of these agencies are subject to change through acts of Congress or local legislatures or even committees of these bodies — not to mention the decisions of levee districts, water-masters, state and federal judges and others indirectly affected by water control.

To cap it all, a new factor is now coming into the picture — a factor which could destroy what remains of the objective, statistical basis of hydrology. The reference is to rain-making!

Systematic Weather Control

Experiments with cloud-seeding are promising enough for us to expect ultimate success. At present, under favorable conditions, computed local increases of as much as 15 per cent in the rainfall over a significant period have been noted. However, nobody says that the total quantity of rainfall will be increased by rainmaking. The sole result will probably be to re-distribute the rainfall in a manner only partly subject to prediction or analysis. Not to mention the politics of when and where it rains and how much.

There have been, as yet, no articles in the scientific or engineering journals discussing the probable effects of systematic weather control upon the validity and usefulness of previously recorded data: be it runoff, river-stage, rainfall, water quality, sedimentation, reservoir capacity or the reliable yields of existing water supplies. Not to mention air-traffic patterns, the capacities of storm sewer systems, ground-water recharge or the availability of water for farm stock ponds.

But weather control is not the only factor which makes the evaluation of water resources, as presented in engineering handbooks, more academic than of practical importance. As has already been suggested, the existing plans for water-utilization projects are, in themselves, hydrologic variables that must be taken ino account. And, as yet, no one knows exactly

Quotes and Excerpts

Handbook excerpts* on runoff and storage are academic

In reference to a U.S. map showing lines of equal average annual runoff—"The indicated mean annual runoff for a given year is a generalized one, local variations due to geology and soil cover, especially to topography, causing departures from the average for the region."

In regard to a need for permanent or temporary stream gaging stations to obtain necessary data—"In humid regions such as eastern United States where fairly uniform conditions prevail, it may be permissible to compute runoff as being proportional to the drainage area."

In speaking of utilization studies—"The various techniques for determining reservoir-storage requirements to meet water utilization demands are described. . . . These techniques which include the flow-duration curve, the mass curve, and the residual mass curve are based on stream gaging records with corrections applied for evaporation from the reservoir surface. Inasmuch as future operation of the reservoir and the expectation of safe yields are based on past records, it is apparent that these records must be of sufficient length to include samples of extremely dry and wet periods that occur at infrequent intervals."

*Handbook of Applied Hydraulics, pp 1183 & 1186.

The effects of a record low stage on the Mississippi at St. Louis (*Engineering News Record*, Nov. 1, 1956):

Gen. Berrigan, Army Engineers, issued this statement in Chicago:

"The situation is critical, and the pools are being lowered only as a last resort. Navigation has already been severely reduced because of inadequate depths over the lower sill of the Alton Lock (Dam 26). Furthermore, as the tailwater (river below the dam) continues to fall, it also becomes advisable to lower the pool above the dam to protect the structure from excessive hydrostatic pressure. . . . Two-thirds of the water in the Mississippi River at St. Louis has come from the Missouri River; largely from Corps of Engineers storage projects. . . .

"In Omaha, the position of Maj. Gen. C. E. Galloway, Missouri River Division Engineer is that he cannot cut loose Missouri River water to help St. Louis. Dams on the Missouri River were built as part of the Pick-Sloan Plan for benefit of the Missouri Basin. The manner in which Missouri River water is allocated is set out a year ahead by cooperative agreement among ten states and seven federal agencies represented on the Missouri Basin Interagency Committee. . . .

"A spokesman for Union Electric described for ENR the extent to which company operations might be affected and the means by which Union Electric hopes to keep the worst from happening. He said the company had never faced such a shortage. (They look for the Mississippi to drop down to —8.0 or —8.4).

" 'At —6.0,' he said, 'we lose one of our old power plants, the Ashley plant . . . for generation of power.' At —7.0 the losses would reach 10 to 15 percent; the company has reserves that can make up this difference. But at —8.0 fully a third of generating capacity would be lost and it would be necessary to shed industrial load. This would mean industries in the St. Louis area would shut down at least in part for want of power.

"Even before things reached this point, industries would be suffering from direct loss of water. The intake for the big Anheuser-Busch brewery will be out of water at —5.5."

The ENR summary:

"Below —5.5 municipal supplies in the East St. Louis area would have real trouble getting water, while in St. Louis and its surrounding country the problem would be in treating it.

"At —7.0 navigation, already hampered by low water will cease for all practical purposes, causing serious shortages of fuel oil and coal in the Chicago and upper Mississippi Valley areas.

"Below —7.0, power generation, needing cooling water, will be cut to an emergency degree in the St. Louis metropolitan area. . . .

In the face of this crisis the Corps of Engineers in St. Louis, Chicago, Omaha, and Washington is at work on the ways to ease if not avert it. The hope is to keep river level in this critical reach around St. Louis from dropping below —7.0, and without rain it looks like a lost cause."

how — the silence of the handbooks on this score is significant.

Water Utilization, by Whom?

As an example of the shadow of future complications let us take a quick look at conditions in the St. Louis area where, during periods of drought, the political situation governs the maintenance of river-stage and, consequently, the depth of water over the intakes of sundry power plants, private and public water supplies, and the sills of navigation locks not to mention the price of fuel oil in Chicago. *Political situation* means the resultant of the free-for-all between the Lake States and River States, the Army Engineers at the District and Division level, the Governors of the States controlling the Missouri Valley, and, last but not least, the U. S. Supreme Court (the treaty with Canada also comes in here somewhere, but the mechanism is not clear). It is not even certain that all of the *players* have been named or what *game* is being played! But on with the story:

St. Louis is located just below the junction of the Mississippi and Missouri Rivers, at the head of the uncontrolled, or "open" Mississippi River. For a number of years the channel of the Mississippi has been dredged for the benefits of navigation. Repeated Federal appropriations have been used to improve the hydraulic efficiency of the channel both for navigational purposes and for the sake of reducing flood heights. The wellknown cut-off program in the Lower Mississippi River has been operating for between 15 and 20 yrs. Naturally, the improved hydraulic efficiency has enabled the river to cut its channel deeper. Inevitably the stage at St. Louis, for a given rate of discharge, has decreased. For example at 50,000 cfs the stage at St. Louis went from about 0 ft on the Market St. Gage to about —4.2 ft between 1920 and 1955. By 1960 if present trends continue, the stage will be about —4.9 ft for that discharge.

For a number of years St. Louis has used the Mississippi River for water-supply, navigation, and to aid in production of electricity. By 1920 a 55-year record of river-stage was available. Thus, the designers of intakes had a better-than-average record to work on. Similarly the Corps of Engineers was in a good position from the standpoint of available records when they designed the Alton-Granite

City canal. Was the record adequate? It might have been, were it not for other, independent, plans for water control. The results of overlooking this *hydrologic data* by the designers of structures 30 years ago or 10 years ago is exemplified as follows:

1956 was a very dry year. At St. Louis the river level dropped and as a dry September was succeeded by a drier October, the predicted stage of the river caused much concern. When all calculations were made, including the scheduled cutback of water to be released from the main stem Missouri reservoirs, the lowest river stage on record (not necessarily the lowest discharge) — far lower than anyone had anticipated — loomed as a distinct possibility (see Box).

The effects of the low river stage would have been wide spread had the stage dropped lower but the Supreme Court helped save the day by authorizing a temporary increase in diversion of water from Lake Michigan. Flow through the Chicago canal into the Illinois River, thence to the Mississippi, raised the flow from 1500 to 7000 cfs despite objections from states bordering the Great Lakes. Finally, it rained. You will recall that the following year, 1957, was an extremely wet year.

It would appear that the age of unrecorded and, some respects, unknowable hydrologic data is upon us. Apparently, to borrow sociological terminology, the day of the *inner-directed* engineer who works with objective data is coming to a close. The dawn of the day of the *other-directed* engineer, who can evaluate the plans, and shadows of plans, by people and organizations unknown, is now upon us.

Well, engineering being an applied science, engineers will meet the problem somehow, although design failures will become increasingly costly. The consultant of the future will have to be a man well familiar with political and social conditions, trends in technology and administration, and a first class technician, to boot. The gap between the first-class engineer and the "handbook" engineer will widen and the feeling will grow that you can't pay the first one too much or the second one too little.

Control of Evaporation Losses

An interim report submitted to the United States Senate, Committee on Interior and Insular Affairs, published April 14, 1958 is summarized as follows:

Evaporation from water surfaces is a major cause of water loss in the United States. This loss is greater than the amount of water that is withdrawn for cities and towns. The effect on water supplies is significant even in the humid areas.

In the 11 Western States, evaporation from water surfaces averages 11.5 million acre-feet a year. In most western river systems, this loss of water before it reaches the locations of use is one-third as much as the consumption by irrigated crops. In many western areas, evaporation from water surfaces is a critical factor in balancing water supplies and water needs. In the Southwest where the water supply situation is especially acute, evaporation losses are highest in relation to the supplies available.

Reservoirs are essential for the conservation and control of western water resources but they also are a major source of evaporation losses. In the Colorado River system, for example, water lost by evaporation from existing reservoirs averages about one-fifth as much as the consumption by irrigated crops, and evaporation from the storage units now under construction will equal more than one-third of the replacement storage that they will provide.

Evaporation from small storages, especially stockwater tanks, seriously affects conservative use of land resources in many areas, and it often is an obstacle to efficient livestock operations. The amount of water evaporated from stock tanks often greatly exceeds the amount used.

Reduction of losses is accomplished mainly by storing water at maximum average depths, and also by such other methods as phreatophyte control and use of underground reservoirs. Such water conservation measures undoubtedly will be used increasingly as water supplies become tighter, but physical and economic conditions limit their application. Large quantities of water will have to be stored at relatively shallow depths and, up to the present, this has meant that high evaporation losses have been unavoidable.

New methods for chemical protection of water surfaces now give promise of effective evaporation control. In field-scale tests, hexadecanol reduces losses generally in the order of 20 to 30 per cent. This method, while still in the stage of test and development, appears to be susceptible of practical application at costs within economic limits.

Use of hexadecanol films for evaporation control is not a hazard to health according to the Public Health Service. Other investigations report no significant effects on domestic animals, wildlife, fish, or aquatic biological and stream sanitation conditions.

CSIRO, the Australian Government research agency, recommends hexadecanol control of evaporation from small storages such as stock tanks. It estimates that in arid parts of Australia this method will save about one-fourth of the evaporation loss. The cost there per acre-foot of water saved is estimated as between $12 and $25 per acre-foot of water saved.

For stock tanks and small storages, technical workers consider that it would be practical in this country to use hexadecanol methods similar to the Australian method. Data are not available for tests to estimate costs here. Extensive demonstration-type tests could provide this information and at the same time work out practical adaptations and improvements.

Hexadecanol control of evaporation from reservoirs is not yet sufficiently advanced to warrant recommendations as to methods or costs. Several organizations in this country and abroad are working on development of practical methods, and successful results are reported from Australia.

Engineering Enigma

In Russia, we are told, about 25% of all graduate engineers are women. In America the figure is less than 1%. It this good—or bad?

Of all the great industrial nations, the one that has clung most tenaciously to a system of private enterprise (capitalism) is the one that today has come the closest to the socialistic dream of producing an abundance for all.

Lancaster, Pa. developed a new source of supply and treatment facilities for . . .

Improved Water Service

by C. C. WILBUR, of Gannett, Fleming, Corddry & Carpenter, Inc., Harrisburg, Pa.

EDITOR'S NOTE: The author describes a municipality's problem of a continual increase in water consumption which threatened to outrun the design capacity of existing facilities. He tells of the actions taken to develop a new source of supply, construct treatment facilities and improve the distribution system.

The problem of meeting new demands for water service is one which many municipalities are facing today. At Lancaster, the increase in consumption was primarily associated to meeting industrial demands rather than higher domestic consumption.

■ IN 1840, Lancaster, Pa. had a population of 7,000; by 1930 it reached 60,000. At about this date, the desirable residential areas within the city limits were occupied. Although the city did not appreciably extend its boundaries, the suburban population began to increase and the city extended its water lines into some suburban areas. As a result, the total population served by the city water plant in 1953 was about 73,000. Another 6,000 was served by the Lancaster Suburban Water Company, a company that obtained the bulk of its water from sources other than the city supply.

It was estimated that the city and suburban population to be served in 1980 would be 88,500 and in the year 2,000 it would reach 100,000. The residential per capita use also increased in Lancaster, in keeping with the general trend throughout the country, however, the overall increase was attributed largely to industry.

The city placed a 16 mgd filter plant in operation in 1934. In the next 17 years, the population increased 19 per cent, but water consumption increased 56.5 per cent. On a basis of peak months, the per capita use in 1940 was 110 gpcd and in 1952 it was 174 gpcd. During this same period, peak day consumption increased from 125 to 205 gpcd. This latter peak brought the total output up to 14.9 mgd, which was close to the existing plant capacity. (In 1953 peak plant delivery was 16 mgd and in 1954 16.9 mgd.)

Water Source

Conestoga Creek, which flows along the eastern boundary of the city has been the only source of raw water. It has a watershed of 322 sq mi and originates from several small streams in the Blue Ridge Mountains, some 15 miles north of Lancaster.

Flow records of the Conestoga were available for many past years. The record of the drought years of 1930-32 disclosed one period of 35 consecutive days where 14 days showed flows of less than 16 mgd (present plant capacity) with a minimum of 4.5 mgd.

After leaving the mountains, the Conestoga flows nearly 15 miles through a flat plain densely populated with dairy farms. A type of watershed which does not provide the best quality of raw water, nor an area suitable for locating a dam to provide the necessary storage for a drought period. Storage could be obtained in the mountain areas, but this would have required a 15 mile gravity conduit. These two factors gave a high cost for raw water which still required filtration; therefore, the Conestoga was not felt suitable to be a source for increased supply.

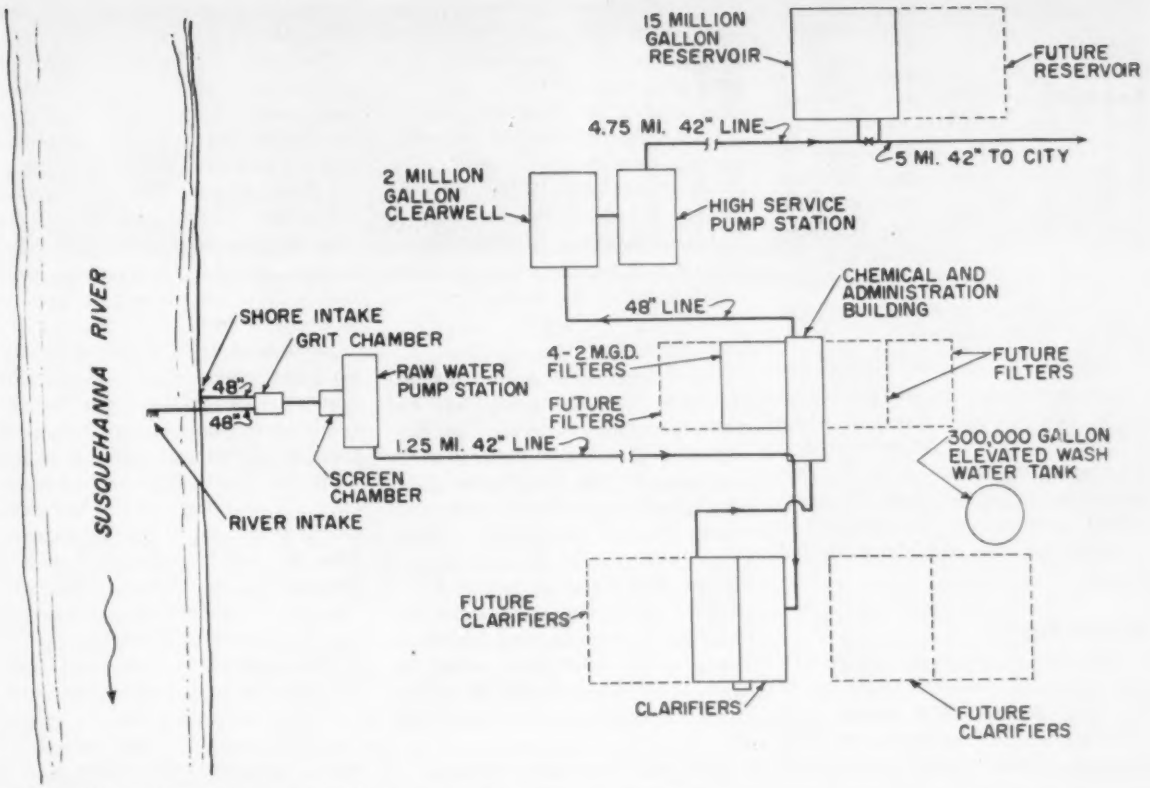
The Susquehanna River, located ten miles west of the city, is used by many communities as a source of supply. It was also considered capable of providing the city of Lancaster and its suburbs with an adequate supply, at reasonable cost, for both present and future needs.

Filtered Water Storage

The filter plant could not operate at full efficiency due to lack of storage for filtered water. There were three standpipes in the city, one in the east end holding 0.5 mil gal and two in the west end holding a total of 6 mil gal. Their base elevations were not high enough to make all of their capacity available for normal use. In addition the city had open ground storage of 6 mil gal which was pumped into the 0.5 mil gal standpipe as required. Normally, the standpipes would be filled by midnight, or slightly later, and plant output would have to be reduced until the morning demand. This was the case when the study was made, but before new construction was begun, the demand had risen to the point in hot weather that standpipes could not be filled on some weekends with the plant operating at full capacity.

Recommendations

The evaluations of water source, consumption and treatment suggested



SCHEMATIC of Susquehanna River Filter Plant, City of Lancaster Authority, Pa.

the following recommendations:

1. The Susquehanna River be used as the source of a new supply with an ultimate use of 32 mgd.
2. A filter plant be built 1¼ miles east of the river with an initial capacity of 8 mgd.
3. A reservoir 4¾ miles east of the filter plant be provided.
4. A transmission line be laid to connect filter plant with the reservoir and bring water into Lancaster.
5. Additional suburban lines with small storage facilities be included in the project.
6. The present filter plant and pumping station on Conestoga Creek be given some extensive repairs and improvements.
7. Construction and Financing be handled by the formation of an Authority and the sale of revenue bonds.

The city approved the recommendations, and while the new facilities were under design, the rehabilitation of the old plant was undertaken.

Modifications to Old Facilities

The operating floor of the old pumping station which pumped both raw water to the filter plant and filtered water to the city was below flood level of the Conestoga. Since the station experienced several floods in the past, a large sump had been installed and provisions were available for bulkheading the doors. The old switchgear mounted on the floor which was undersized and outmoded was replaced by a new control cabinet. The new cabinet was installed above floor level, without interruption of service. Motor windings on all pump motors were rewound at a cost of about 35 per cent that required to buy new motors.

New manifolds were placed on operating tables in the filter plant. Loss of head and rate of flow gauges were replaced with new ones of pneumatic operation. The wash water valves were replaced with new valves and rehabilitated hydraulic cylinders.

The major improvement was to replace the old clarifier with new upward flow types. The old clarifier, 80 ft sq and 10 ft deep, had a retention period of only 5½ minutes, and removed only the coarser sediment. Two new upward flow type units with provisions for recirculation of sludge had a total retention time of 90 minutes at a flow rate of 16 mgd. This short period was felt to be ample for two reasons: The equipment provided twelve minutes for mixing and flocculation, and the new clarifiers are followed by two basins with theoretical retention periods of four hours.

These clarifiers were guaranteed to produce an effluent containing not over 10 mg/L turbidity. This requirement has been met consistently by an effluent usually below 5. New chlorinators were installed for prechlorination.

The 0.5 mil gal standpipe in the east end was leaking and found to be beyond economical repair. This was replaced by an elevated tank of the same capacity.

Construction of New Facilities

Bids

Bids on fifteen contracts for the new facilities were received in November 1955 and contracts were awarded in December. These bids included the Susquehanna River intake and raw water pumping station, the filter plant and pumping station, the reservoir, eleven miles of transmission line, five suburban distribution systems covering 29.8 miles of pipe, two standpipes and two booster stations.

The lowest bid of $5,132,000 was 10 per cent under the engineer's estimate. Due in part to limestone which is common in the Lancaster area, a contingent allowance of 8 per cent was added to the bid totals. The completed contract cost was expected to be about 6.5 per cent above the bid prices.

Storage Reservoir

The new reservoir is a square, 15 mil gal covered tank. The design of one wall of the 320 ft square tank provides for tank enlargement when desired. Filtered water from the new plant enters at one corner and leaves at the diagonally opposite corner. Its effluent elevation is ten feet above that of the 5 mil gal standpipe in the west end of the city.

Estimates suggested that some economy might be achieved by the use of precast columns with prestressed beams and girders plus precast channel roof slabs. The roof was designed to carry one foot of earth cover plus 100 pounds live load. The total contract cost amounted to $37,785 per million gallons. The reservoir was completed early in 1957. This reservoir permitted the Conestoga filter plant to operate at full capacity at all times. But even with this output, only on rare occasions was the reservoir full during the summer months.

River Intake

The Susquehanna is not a navigable river. It contains many dams and power generating stations. The Borough of Columbia is at the head of the pool formed by the Safe Harbor Dam. The river here is about a mile wide and in low flow periods has a maximum depth of 8 ft. The site selected for the main intake is located 400 ft offshore where the river bottom was found to be clean bedrock limestone. Flows in the river have varied between 1700 cfs and 691,000 cfs with an estimated maximum flow of 800,000 cfs.

The intake line was constructed of 48 inch concrete pipe with the top about one foot below bedrock. The cut was filled with concrete to the top of the rock. The intake itself consists of a manifold with six 24 inch vertical openings facing downstream. The inlets are faced with a grill of bars 6 inches on center each way. The bottom of these inlets are one foot above the river bed.

The area is subject to some high water flooding due to ice jams, therefore, a second intake has been constructed at the shore line to obtain water with less or finer turbidity during flood periods. The second intake can be used about eight months in the year, but is primarily designed for use in flood periods. The extreme variation in river level was considered to be about 19 feet.

Records of the Borough of Columbia's filter plant (about one-half mile upstream) showed that a grit chamber would be warranted. Two have been constructed but grit removal equipment was installed in one chamber only. A traveling screen has been placed at the end of the grit channel. The wet well was designed with a dividing wall containing a sluice gate. The use of standard horizontal pumps was considered for mounting in the standard position or in a vertical position with the motors above flood level. The first installation consists of one 8 mgd unit and two 4 mgd units. They operate very smoothly under a total dynamic head (TDH) of 95 ft. The ultimate design capacty provided for is 48 mgd.

Treatment Plant

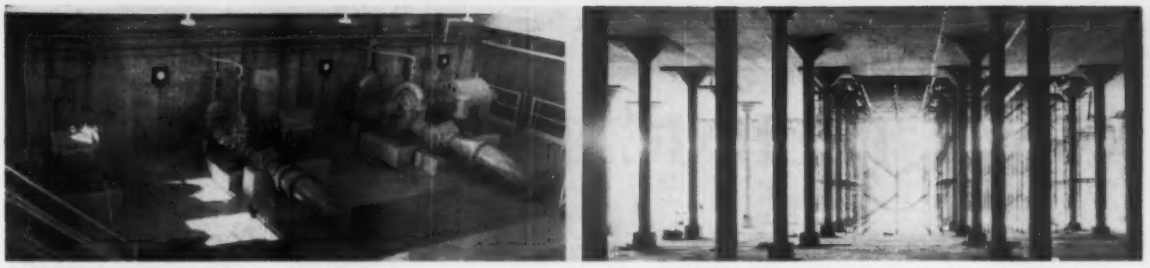
Present construction consists of four 2 mgd filters. Pipelines, chemical building, etc. were planned and are being constructed for an ultimate capacity of 32 mgd.

The raw water line passes through the chemical buildings for ease in feeding chemicals. The Susquehanna River has a low alkalinity (20 to 40 mg/L) and at times high turbidity. Alum, lime, activated silica and chlorine are used during periods of high turbidity. The alum is introduced into the line in a valve vault about 140 feet ahead of the other chemicals. Sufficient chlorine is applied to carry a slight residual through the filters. Post chlorination is provided by means of chlorine dioxide for the destruction of phenols which are present in the river at times.

Two chlorine residual recorders are in use; one giving the residual as the water leaves the filters and the other recording the residual of the water as it is pumped to the 15 mil gal reservoir.

The present four filters are 25 x 28 ft with Wheeler bottoms and concrete

AERO-VIEW of the Lancaster Authority Susquehanna River Plant



HIGH-SERVICE PUMP STA. and 1.5 mil. gal. storage tank supply the additional required water to City of Lancaster.

wash water troughs. The filter bed is Anthrafilt with Palmer surface wash operated at about 100 pounds pressure. Wash water comes from a 300,000 gallon radial cone bottom elevated tank which gives a small variation in head.

Pipe gallery valves are hydraulically operated. Valves of 18 inch and larger are rubber seated butterflys while these smaller are square bottom gate valves.

The main doors, sash and screens, inside railings and structural material for glass partitions are made of aluminum in the building itself. Interior walls are either glazed or unglazed tiles. The unglazed tile has an initial cost less than plaster on block or brick, presents a neat appearance and is easy to clean. In the interest of good public relations, an attempt was made to have the buildings present a pleasing appearance. An unusual number of trees and shrubs have been planted.

Pipelines

The filter plant is located 1.25 miles east of the Susquehanna River and the reservoir is 4.75 miles east of the filter plant. The Lancaster City Limits are 5 miles east of the reservoir. A 42 inch pipe was selected for the three sections of transmission line totaling about 11 miles. This piping will allow a velocity of 5.15 ft/sec at a flow rate of 32 mgd. These valves are slightly lower than the economic velocity found in studies for such pipelines, however a 36 inch line would have had a velocity of 7.0 ft/sec which is too high for pumping economy.

The first section of 1.25 miles passes through three large existing culverts and several thousand feet in a paved street of the Borough of Columbia. This street is occupied with gas, water and sewer lines.

The second section, from the filter plant to the reservoir, is entirely in open country passing under only one major highway. This line could be easily paralleled by a second line without great difficulty.

The third section from the reservoir into the city passes under two railroad tracks, through an alley in a suburban community, over a mile on the right-of-way of a state highway and along city streets for 1.5 miles. A parallel line in this area at any future time would be very nearly impossible to construct.

These facts support the decision to slightly oversize the line to 42 inches I.D. It was also desirable to use a standard diameter which would allow concrete pipe manufacturers to bid as well as those making steel pipe. The coefficient "C" in the Hazen-Williams formula was taken at 130, a value felt to be suitable on a long time basis.

The future maximum total dynamic head on the pipeline will result in a pressure of 110 pounds plus water hammer. Steel pipe of 5/16 inch wall thickness is rated at 180 lb maximum working pressure and is also the minimum thickness in which 40 ft lengths can be handled by a single sling without causing deflection which might crack the coating. Therefore, a 42 x 5/16 inch steel pipe in 40 foot lengths was specified. Concrete pipe was also permissible with standard lengths of 16 ft.

The work of laying this line was placed under two contracts, the reservoir being the dividing line. This made the length of the two contracts about 5 and 6 miles respectively.

No bids were received on concrete pipe probably due to the thin wall specified for the steel pipe. A total of thirty-four bids were received on the two contracts.

Pipe was coated inside and outside with coal tar enamel. The exterior was single wrapped with fifteen pound felt. Connections were made with Dresser couplings; the following rings were placed on the pipe at the point of fabrication. After installation in the trench, enamel was poured over the couplings.

One railroad crossing was made in earth fill. The railroad required placing the 42-inch line in a 60-inch concrete or corrugated culvert pipe. This portion of the pipe was welded and rolled into place. After testing the pipe, the ends of the culvert were bricked up, leaving only small openings for ventilation.

The pipe was fabricated at Steelton, Pa. by the Bethlehem Steel Company, and delivered by trucks to the side of the trench. The usual load was four lengths with an average haul from shop to trench of less twenty miles. This method of delivery was found to be very convenient for getting special sections of pipe on the job site when they were needed.

Very little damage was observed from handling the pipe. Leakage tests standards permitted a maximum leakage of 40 gal per hour per mile at 150 psi. The first section tested disclosed two unbolted couplings but with this corrected, the entire line tested high above requirements.

The irregular terrain traversed by the thin walled 42 inch line required a considerable number of air release and vacuum valves. The first five mile section from the city to the reservoir required 18 six-inch valves. These were installed in clusters of two or three. Six 2 inch air release valves were also required. Six 36 inch valves of the butterfly type with rubber seats were placed in the same section. These valves are very easy for one man to open or close.

The city of Lancaster now has ample water for some years to come. When future demand exceeds the present two plant capacities (24 mgd), additional pumps, clarifiers and filters can be added to the Susquehanna River plant to bring production to 48 mgd.

For the 79th Annual Convention, scheduled for San Francisco, California, July 13-16, here is the tentative . . .

AWWA TECHNICAL PROGRAM

The AWWA San Francisco meeting will present the following technical sessions. Some minor changes may be made in these listings, according to Harry E. Jordan, AWWA Secretary.

Monday, July 13, A.M.

(1) Water Works Development-Management

9:00 a.m. Motion Picture
9:30 a.m. Upgrading the Water Supply Industry ..... L. S. Finch
10:00 a.m. The Business and Defense Services Administration ..... H. B. McCoy
10:30 a.m. AWWA's Water Works Advancement Program ..... James B. Corey
10:50 a.m. Promoting Good Community Relations
10:50 a.m. Good Utility Citizenship—What It Can Mean ..... M. M. Jorgensen
11:10 a.m. Count Down to Oblivion ..... Robert Gros
11:30 a.m. Representative of National Education Association
11:40 a.m. General Discussion

Monday, July 13, A.M.

(2) Purification Division

9:00 a.m. Motion Picture
9:30 a.m. Radioactivity of Surface Waters of the U. S. ..... L. R. Setter
9:50 a.m. Discussion (10 minutes each) ..... H. H. Gerstein, Harry P. Kramer, Harold E. Pearson, James C. Vaughn
10:30 a.m. General Discussion
10:40 a.m. Water Analysis by Neutron Activation ..... Harry P. Kramer, R. L. Blanchard, G. W. Ledicotte, D. W. Moeller
11:00 a.m. Discussion
11:10 a.m. Stabilization of Magnesium Hydroxide by Up-Flow Clarifiers
11:40 a.m. Discussion ..... T. E. Larson, H. O. Hartung, J. L. Tuepker

Monday, July 13, P.M.

(3) Joint Water Resources and Management Divisions

1:30 p.m. Motion Picture
2:00 p.m. Development of the Upper Colorado River ..... Ernest O. Larson
2:20 p.m. Discussion
2:30 p.m. The Philosophy of a Model Water Law ..... Arthur M. Piper
2:50 p.m. Discussion
3:00 p.m. East Bay's New Aqueduct ..... James W. Trahern
3:20 p.m. Discussion
3:30 p.m. Water Well Stimulation—A Survey of Current Practices ..... Louis Koenig
3:50 p.m. Discussion
4:00 p.m. Application of Hexadecanol to a Municipal Water Storage Reservoir ..... Morrison B. Cunningham
4:20 p.m. Discussion

Monday, July 13, P.M.

(4) Joint Distribution and Purification Divisions

1:30 p.m. Principles of Coagulation ..... A. P. Black
1:50 p.m. Discussion
2:00 p.m. Conversion of Saline Water .. Everett D. Howe
2:30 p.m. Discussion ..... Sheppard T. Powell
2:45 p.m. New Delhi Hepatitis Epidemic ..... Joseph M. Dennis
or Abel Wolman, Norman Clarke, Richard Woodward
4:00 p.m. Panel Discussion—Cross-Connection Control — Andrew Dempster, (Moderator), E. Jerry Allen, Henry J. Ongerth, Ray L. Derby

Tuesday, July 14, A.M.

(5) General-Resources Division

9:00 a.m. Motion Picture
9:30 a.m. Progress of the California Water Plan ..... M. J. Shelton
9:50 a.m. Discussion
10:00 a.m. Water—America's Number One Problem ..... Fred A. Seaton
10:45 a.m. Discussion
11:00 a.m. New Jersey's Forward Step in Water Supply ..... William J. Orchard
11:20 a.m. Discussion
11:30 a.m. San Francisco's Water Supply ..... James H. Turner
11:50 a.m. Discussion

Tuesday, July 14, A.M.

(6) Purification Workshop

9:30 a.m. Task Group Reports
Membrane Filters ..... J. E. McKee
Filterability Index ..... Joseph M. Sanchis
Diatomite Filters ..... E. Robert Baumann
Radioactive Contamination ..... Harold E. Pearson
Synthetic Detergents ..... Paul D. Haney
Filter Backwashing ..... J. E. McKee
Biological Infestation ..... Marshall P. Crabill
10:45 a.m. Research Reports
Water Treatment Effect on Main Capacity ..... T. E. Larson
Protective Coatings for Mains ... Robert F. McCauley
Chromium/Cadmium Tollerance ..... R. U. Byerrum
Coagulation ..... A. P. Black
Manganese Problems ..... A. E. Griffin
Chlorine Impurities ..... Thomas DeVries
11:45 a.m. Election of Officers

Tuesday, July 14, P.M.

(7) Purification Division

1:30 p.m. Motion Picture
2:00 p.m. Design Criteria for Rapid Sand Filters ..... John M. Jester, (Moderator), W. W. Aultman, John R. Baylis, Richard R. Kennedy, H. E. Hudson, Jr.

3:00 p.m. Short Filter Run Study—Lake Michigan ..... Merrill B. Gamet, John M. Rademacher
3:30 p.m. Discussion
3:45 p.m. Panel Discussion—Recalcining Water-Softening Sludges
William B. Crow, (Moderator)
Miami, Florida .....C. F. Wertz
Dayton, Ohio .....Wm. T. Eiffert
Lansing, Michigan ...C. R. Erickson
Salina, Kansas .....R. S. Fassnacht
4:30 p.m. Discussion

Tuesday, July 14, P.M.

(8) General—Management Division
1:30 p.m. Motion Picture
2:00 p.m. Consolidating Water Systems in California .....John C. Luthin
2:20 p.m. Discussion
2:30 p.m. The Puerto Rico Aqueduct and Sewer Authority .....Rafael Urrutia
2:50 p.m. Discussion—Regional Water Supply Systems Developed by the Central City .....W. W. DeBerard *or* James W. Jardine
3:30 p.m.—Developed by District Authority .....John W. McFarland
4:00 p.m. Discussion
4.15 p.m. Long-Range Weather Forecasting as a Water Supply Tool .....Irving P. Krick

Wednesday, July 15, A.M.

(9) Resources Workshop
9:00 a.m. Motion Picture
9:30 a.m. Weather Control .....F. W. Decker
9:50 a.m. Discussion .....R. S. Miller
10:00 a.m. Underground Waste Disposal ....Lynn Miller
10:20 a.m. Discussion
10:30 a.m. Ground Water Recharge .....John J. Baffa
Erosion Control
Salinity Reduction
11:30 a.m. Election of Officers

Wednesday, July 15, A.M.

(10) Open Session Water Works Administration
9:30 a.m. Motion Picture
10:00 a.m. Report of General Chairman
10:15 a.m. Task Group Report—Rating Water Systems .....John Murdock
10:30 a.m. Discussion
10:40 a.m. Task Group Report—Job Classifications .....Robert S. Millar
10:50 a.m. Discussion
11:10 a.m. Domestic Water Use .....H. E. Hudson, Jr.
11:30 a.m. Discussion
11:45 a.m. Pension and Retirement Systems .....John Copley

Wednesday, July 15, P.M.

(11) Joint Management and Distribution Divisions
2:30 p.m. Motion Picture
3:00 p.m. Mechanics of Bond Election Campaigns .....F. H. Eastman
3:30 p.m. Maintaining Public Support of Water Works Improvements .....Milton Rosen
3:50 p.m. Discussion .....Robert S. Millar
(and others)
4:15 p.m. Highway Regulations Relating to Utility Facilities ..... Bruce Baty, (Moderator), Edward Clark, Robinson R. Rowe, Herbert Chapton, C. F. Wertz, F. E. Dolson, David Auld

Wednesday, July 15, P.M.

(12) Open Session Water Works Practice
2:30 p.m. Certification of Water Works Materials ..... L. S. Finch, H. E. Jordan
Research on Water Meter Casings .....H. F. Barrett
AWWA's Interest in International Standards .....S. Logan Kerr
Reports: Cast Iron Pipe Committee ..Raymond J. Faust
Spillway Committee .....Raymond J. Faust
Discussions:
Plastic Pipe Use and Experience Therewith .....R. J. Faust
Epoxy Resins as Protective Coatings .....L. Tabor
Standard Designs and Diagrams for Blocking of Pipe Bends, Plugs and Fittings
Types of Valves for Distribution Systems .....Leslie Paul

Thursday, July 16, A.M.

(13) Management Division
9:00 a.m. Motion Picture
9:30 a.m. Blue Sky Thinking—The Water Works of the Future .....Victor A. Appleyard
9:45 a.m. .....William R. Seeger
10:00 a.m. Discussion
10:15 a.m. How Much Does Your Accident Price Tag Show? .....George Sopp
10:40 a.m. Discussion
10:50 a.m. Changes in State Laws Concerning Public Liability .....Gerald Remus
11:20 a.m. Discussion
11:30 a.m. 25 Years of Parallel Private and Public Utility Operation .....Peter C. Karalekas
12:00 noon Discussion
12:15 p.m. Adjourn

Thursday, July 16, A.M.

(14) Distribution Division and Workshop
9:00 a.m. Motion Picture
9:30 a.m. The Role of the Corrosion Engineer in the Water System .....Paul Beermann
9:50 a.m. Discussion
10:00 a.m. Distribution of Soil Conductivity and Its Relation to Corrosion .....Gordon N. Scott
10:20 a.m. Discussion
10:30 a.m. Ground Storage vs. Elevated Storage .....Marsden C. Smith
10:50 a.m. Discussion
11:00 a.m. The Effect of Valve Operation on Water Hammer .....S. Logan Kerr
11:20 a.m. Discussion
11:30 a.m. to 12:00 Distribution Workshop—Election of Officers—Remarks by the Chairman

Thursday, July 16, P.M.

(15) Management Workshop
2:00 p.m. Budgeting and Cost Accounting Systems at work ..... J. P. Dieter, C. E. Hemphill
2:45 p.m. Compensation of Water Works Managers ..... Garvin Dyer
Discussion ..... Raymond J. Faust
3:15 p.m. Panel Discussion The Need for Demand Meters: George H. Dann, Moderator; W. Victor Weir; M. P. Hatcher; Roy Wehe
3:45 p.m. Meter Manufacturer's Viewpoint ..... W. P. Hersey, M. E. Hartz, J. P. O'Grady
4:30 p.m. Election of Officers

WSWMA Members to exhibit at this meeting are listed under News of Suppliers.

Part Eleven of this series on the Design, Construction and Maintenance of Centrifugal Pumps introduces the subject of . . .

Antifriction Bearings

Part I

by IGOR J. KARASSIK
Consulting Eng. and
Manager of Planning
Harrison Division
Worthington Corp.
Harrison, N. J.

EDITORS NOTE: In August 1954 *Water & Sewage Works* began a series on the structural details of centrifugal pumps by Karassik and Carter. The articles of this series appeared during the period ending May 1956 when the work was interrupted by the illness of one of the authors. Mr. Roy Carter passed away in September 1958. Since then, Mr. Karassik decided to complete the series and has resumed preparation of the series. The publication of this, the eleventh part, will be followed in future issues by the remaining seven parts needed to complete the series.

■ BEARINGS ARE required on centrifugal pumps to support the shaft or rotor in correct alignment in relation to the stationary parts under the action of radial and transverse loads. Those which give radial positioning to the rotor are called line or radial bearings, whereas bearings which locate the rotor axially are called thrust bearings. Bearings serving both as radial and thrust bearings are properly called combined radial and thrust bearings but usually are simply called thrust bearings.

Types of Bearings Used

All types of bearings have been used for centrifugal pumps. Often even the same basic design of pump is made with two or more types of bearings as required by various local operating conditions or by preference of the purchasers. On double-suction, single-stage general service pumps, two external bearings, one on either side of the casing, are generally used. These were formerly usually of the babbitted type using oil rings but, of recent years, the standard of most manufacturers especially in the small and intermediate sizes of pumps, are anti-friction bearings using either grease or oil lubrication. While some of the small, inexpensive centrifugal pumps used for pumping clear liquids are made with an internal sleeve bearing as shown in Figure 1, this type of bearing is usually restricted to wet pit designs and may be grease, oil or liquid lubricated.

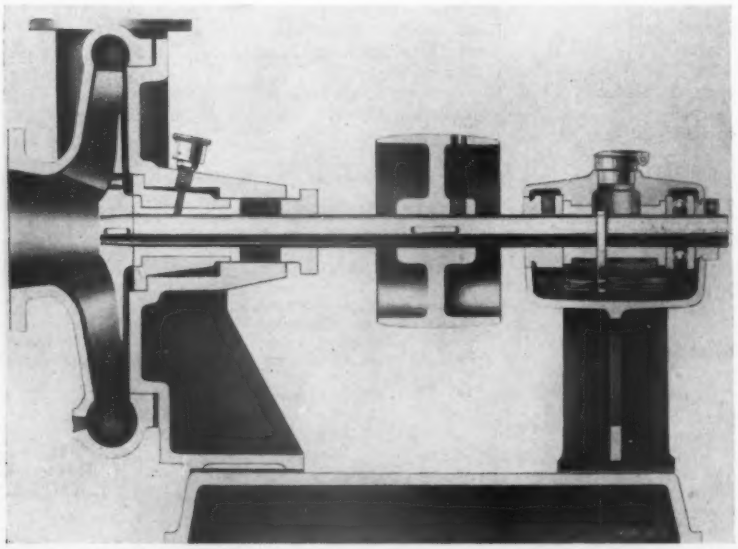


Fig. 1 INTERNAL sleeve bearing.

On horizontal pumps that have bearings on each end, the bearings are generally designated by their location as inboard and outboard bearings, the former being that between the casing and the coupling. Pumps with over-hung impellers have both bearings on the same side of the casing. For these, the bearing nearest the impeller is called the inboard bearing and the one farthest away is the outboard bearing. Generally, when a pump is provided with bearings at both ends, the thrust bearing is placed at the outboard end and the line bearing at the inboard end.

The bearings proper are mounted in a housing which is usually supported by brackets attached to or integral with the pump casing. The housing also serves the function of containing the lubricant necessary for proper operation of the bearing. Occasionally, the bearings of very large pumps are supported in housings forming the top of pedestals mounted on soleplates or on the pump bedplate. These are called pedestal bearings.

In some cases either due to heat generated by the bearing itself or due to heat in the liquid being pumped,

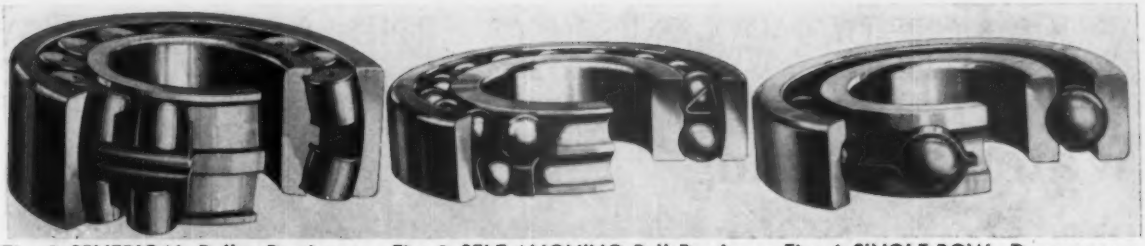


Fig. 2 SPHERICAL Roller Bearing.

Fig. 3 SELF-ALIGNING Ball Bearing.

Fig. 4 SINGLE-ROW, Deep-groove Ball Bearing.

some means, other than radiation to the surrounding air, must be used to keep the bearing temperature within proper limits. When bearings have a forced feed lubrication system this is usually accomplished by circulating the oil thru a separate water-to-oil cooler mounted externally. Where such a system is not used, cooling is usually accomplished by a jacket incorporated as part of the housing, thru which a cooling liquid is circulated. The purpose of cooling is not to chill either the bearing nor the lubricant, but merely to keep the temperature within a desired maximum. Thus the amount of cooling liquid used must be regulated to effect that result. Too low operating temperature can among other undesirable results cause condensation of the moisture from the air entering the bearing thus contaminating the lubricant.

Both rigid and self-aligning type bearings are used on centrifugal pumps. Self-aligning type bearings are those made so they will automatically adjust themselves to the angular position of the shaft. In babbitted or sleeve types the name is applied to bearings having a spherical fit of the sleeve in the housing while in anti-friction bearings it is applied to bearings whose outer race is spherically ground or where there is a spherical fit provided for mounting the bearing in the housing.

Types of Anti-friction Bearings used.

Ball bearings of the various available types are the anti-friction bearings most commonly used in centrifugal pumps. Roller bearings are used to a lesser extent and primarily for radial loads, as most roller bearing designs are only suitable for radial loads. The spherical roller bearing (Figure 2) is frequently used for large diameter shafts both for radial and combined loads as there is a limited choice of ball bearings for large shafts.

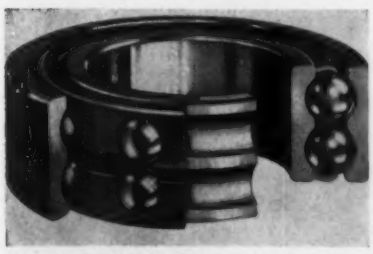


Fig. 5 DOUBLE-ROW, Deep-groove Ball Bearing.

While they are called anti-friction bearings, ball and roller bearings do have friction due to several causes. In the first place, while such bearings have a theoretical point or line contact, the races and balls or rollers are made of an elastic material and under load will deform. While minute, such deformation means a certain amount of sliding friction with the generation of heat. Secondly, most bearing designs incorporate a retaining cage to maintain the balls or rollers in proper spacing. Some sliding friction between this retainer and the balls or rollers results.

A pump designer has a wide variety of anti-friction bearing types to choose from for a design. Each type has characteristics which may make it a good or bad selection for the application under consideration. While in some cases several types might be acceptable, it is best for purchasers to leave the type to be offered to the manufacturer instead of specifying what they desire. For example some purchasers specify double row bearings irrespective of pump size and type and in many cases single row bearings are equally suitable or better.

The more common anti-friction bearings used for centrifugal pumps are the self-aligning ball, single-row deep-groove ball, double-row deep-groove ball, angular contact (single, double or matched pairs), spherical roller, cylindrical roller and the pure ball thrust bearings.

The self aligning ball bearing (Figure 3) has a double row of balls running in fixed grooves in the inner or shaft race with an outer race ground to a spherical surface. Any slight variation in the axis of the shaft is taken care of by this design so it is an ideal bearing if the pump casing may breathe when pressure is developed. It has very little thrust capacity so is not generally suitable for applications where a combined load is involved. With larger shafts, the spherical roller bearing (Figure 2) is favored and since it has considerable thrust capacity, it can be used for combined loads.

The single row, deep-groove ball bearing (Figure 4) is the most commonly used type on centrifugal pumps except for the larger sizes. It is good for both radial, thrust and combined loads but requires careful alignment between the shaft and the housing in which the bearing is mounted. For some applications this basic type of ball bearing is used with seals built into the bearing to exclude dirt, retain lubricant or both.

The double-row, deep groove bearing (Figure 5) is basically two single-row bearings in tandem and has greater load capacity than the single-row bearing.

The angular contact single-row ball bearing due to its construction with a steep contact angle and high shoulders on the races is good for heavy thrust loads or combined radial and thrust loads. The single-row bearing is good only for thrust in one direction. Pairs of matched single-row bearings can be obtained in tandem for greater thrust loading in one direction or face-to-face or back-to-back for thrust loads in either direction. There are also double-row angular-contact ball bearings made.

The cylindrical roller bearings is naturally suitable for radial loads only while the ball thrust bearing is for thrust loads only. Neither are applied to any appreciable extent nowadays on centrifugal pumps.

WATER WORKS PRACTICES

Water Softening

Part 4--Demineralization, Economic Aspects

The 45th of a Series

by GEORGE E. SYMONS,
Consultant and Technical Editor
Larchmont, N. Y.

EDITOR'S NOTE: This installment is a continuation of the general topic of water softening as a part of this series of short school-type lectures designed to assist operators, students, and others who may wish to review the fundamentals of water works practices.

E . . . Demineralization

1 . . The Process

a. It is possible to remove all dissolved ions in water by the process termed demineralization.

b. Water is first passed through a hydrogen cation-exchange unit, and then through an anion exchange unit; the first step converts all salts into the corresponding acids and the second step removes the acids and produces a water almost entirely free of electrolytes.

2 . . Anion Exchange Materials

a. These substances are characterized as a sturdy cross linked structure, basic in nature, resistant to attrition and insoluble over a pH range of 2 to 13.

b. Anion exchange substances are synthetic resins.

(1) Weak base types (Amberlite, IR4B, DeAcidite, etc.) are derived from condensation of aromatic amines with aldehydes; the active parts of the resins are R_3NH^+ groups.

(2) Strong base types (Dowex 2, Dowex 1, Cochranex AT and AL, etc.) are derived from quaternary ammonium compounds; the active parts of the resins are R_4N^+ groups.

3 . . Mechanism

a. In essence, anion exchangers operate on the same basic principle of reaction and exchange under mass action conditions as do cation exchangers.

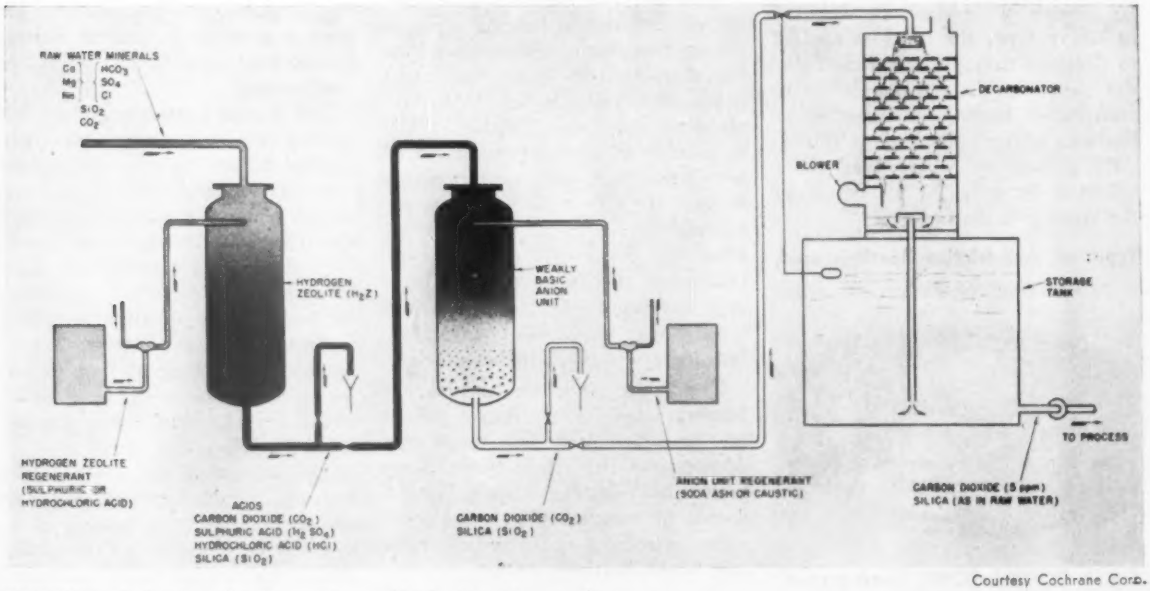
b. Reactions involved in anion removal are:

(1) Weakly basic exchange material.

$$HCl + R_3NH_2 \rightarrow R_3NH_2 \cdot HCl$$
$$H_2SO_4 + R_3NH_2 \rightarrow R_3NH_2 \cdot H_2SO_4$$

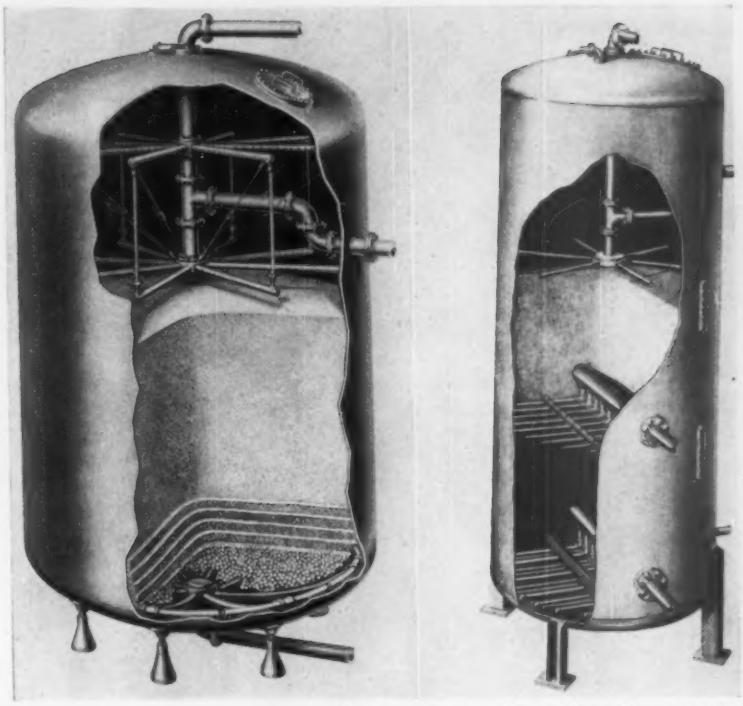
(2) Strongly basic exchange material

$$HCl + R_4NHOH \rightarrow (R_4N)Cl + H_2O$$
$$H_2SO_4 + 2R_4NHOH \rightarrow (R_4N)_2SO_4 + 2H_2O$$
$$H_2CO_3 + 2R_4NHOH \rightarrow (R_4N)_2CO_3 + 2H_2O$$
$$H_2SiO_3 + 2R_4NHOH \rightarrow (R_4N)_2SiO_3 + 2H_2O$$



Courtesy Cochrane Corp.

PROCESS of demineralization with weakly basic anion exchanger.



Courtesy Graver Water Cond. Co.

CUT-AWAY view (left) of typical ion exchanger for either cation or anion exchange in a demineralizing system and (right) of a mixed-bed demineralizer.

c. Reactions involved in regeneration are:

(1) Weakly basic exchange materials are regenerated with soda ash (Na_2CO_3).

$$2(R_3NH)Cl + Na_2CO_3 \rightarrow R_3N + 2\,NaCl + H_2O + CO_2$$

$$(R_3NH)_2SO_4 + Na_2CO_3 \rightarrow 2\,R_3N + Na_2SO_4 + H_2O + CO_2$$

. . . Materials regenerated by soda ash function as acid absorbers rather than true exchangers.

(2) Strongly basic exchange materials are regenerated with caustic soda (NaOH).

$$(R_4N)Cl + NaOH \rightarrow R_4NOH + NaCl$$

$$(R_4N)_2SO_4 + 2\,NaOH \rightarrow 2\,R_4NOH + Na_2SO_4$$

4 . . Application

a. Demineralization has not been used in municipal water supplies, but the increasing development of "tailored" water and the expected establishment of quality product standards for water may see this process come into municipal practices.

b. The process of demineralization is generally applied in industry, where high quality process water is essential; in atomic energy plants; and for producing boiler feed water.

c. Weakly basic anion exchange materials do not absorb silicic or carbonic acids and are used ahead of aerators or degasifiers; strongly basic substances may be used to remove silicic acid.

5 . . Equipment

a. The basic equipment used for demineralizing systems is much like that of cation-exchangers, consisting of a tank (shell) for holding the resin plus piping, tanks for regenerants, automatic valves, etc., but there must be a two stage system: first, a hydrogen cycle cation-exchanger and secondly an anion-exchanger plus a decarbonator.

b. The number and combination of units in a demineralizing system depends on the desired end result and the electrolyte content of the raw water.

(1) One bed systems for partial demineralization may operate on the hydrogen cycle; they are applicable in brackish water to reduce high alkalinities and make the water palatable. The effluent is mixed with raw water to neutralize the free mineral acids formed and is aerated to remove carbon dioxide.

(2) Two bed systems are used where cations, carbonates and sulfates are to be removed. They consist of a hydrogen cycle cation-exchanger, a weakly basic anion exchanger and a decarbonator.

(3) Three bed systems consist of a hydrogen cycle cation-exchanger, weak base anion unit, decarbonator and strong base anion exchanger. They are used to remove silicates as well as carbonates, sulfates, chlorides and cations.

(4) Four bed systems consist of (in sequence) a hydrogen cycle cation-exchanger, weak base anion exchanger, decarbonator, cation-exchanger, and strong base anion exchanger.

. . . The advantages of both three and four bed units include a better quality effluent, savings in the cost of regenerants, and better operation.

(5) Mixed bed demineralizers are employed to remove both cations and anions at the same time. They have two types of exchange material either intimately mixed or separated into two layers.

. . . In regeneration, the mixed bed is separated hydraulically, and the two layers are regenerated separately; after regeneration, the layers may be mixed by compressed air before rinsing.

6 . . Operation

a. Operation of demineralizing systems involve the usual steps of ion removal, and regeneration with the latter operation consisting of washing, regeneration, and rinsing.

b. Automatic control is possible by meters and timing devices.

7 . . Saline Water Conversion

a. For desalting sea water and brackish water, there are several methods:

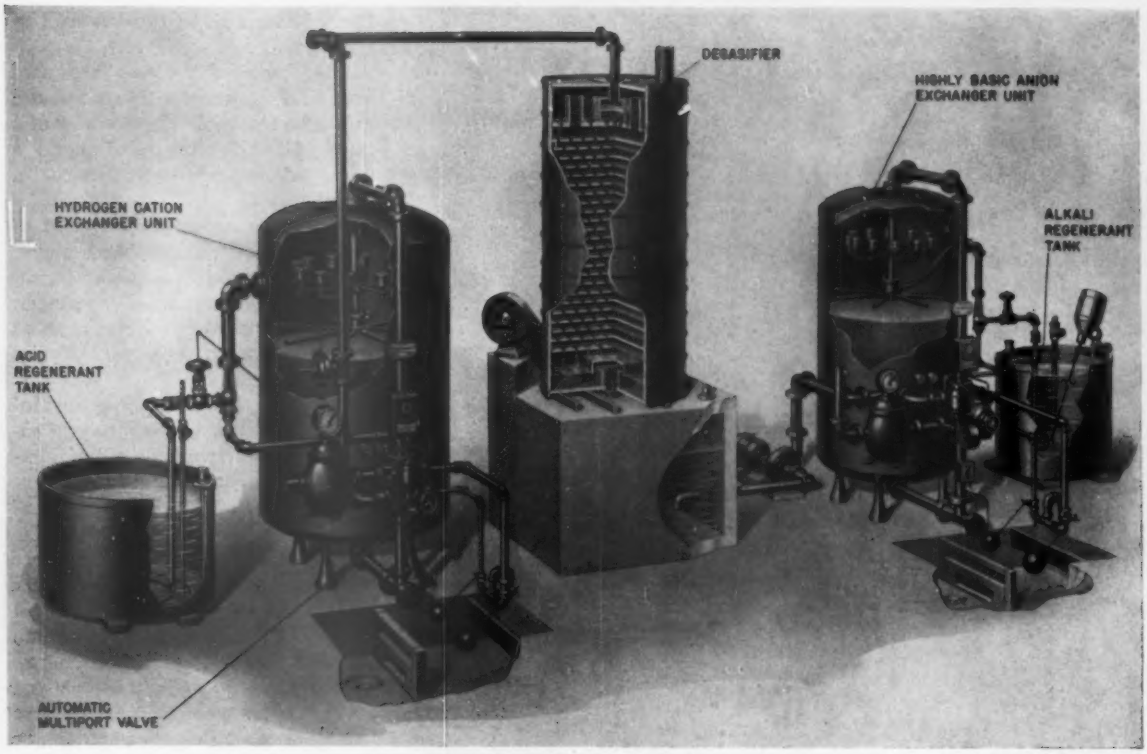
(1) Distillation by multiple effect evaporators.

(2) Vapor compression evaporators.

(3) Ion exchange membranes (electrodialysis) wherein electrical forces (an impressed current) are used to pull cations and anions through selective membranes, leaving demineralized water behind.

(4) Freezing.

(5) Solar evaporation.



Courtesy Permutit Co.

AUTOMATIC two-step demineralizing system with degasifier (cutaway view)

b. A few distillation and ion exchange membrane systems are in operation but saline water conversion is still comparatively expensive and still undergoing experimentation.

F . . . Economic Aspects

1 . . Consumer Costs

a. Under section B-2—"Reason for Softening" it was pointed out that municipal water softening will reduce consumer expenses.

(1) Before the advent of syndets, it appeared that on the basis of decrease in soap usage alone, municipally softened water would save consumers from $0.50 to $9.00 per capita per year, depending on how hard the water is before treatment. (See Table 1*)

(2) Other advantages to consumers include: Lower fuel consumption in heating systems, reduced maintenance of plumbing, longer life of washable fabrics, etc.

b. With the coming of syndets, many observers thought water softening would no longer be necessary, but this expectation has not been borne out.

(1) Syndets do not work as well in hard water as in soft water. The amount of both soap and syndets required for maximum soil removal increases as the hardness of a water increases.

(2) An unpublished study in 1951 by J. Ringrose of Armour & Co. ("Soft Water, Detergents and Textiles") showed the following results:

Hardness mg/L	Cost per Washing	
	Soap	Syndets
17 to 35	$0.04-$0.05	$0.08-$0.10
120 to 170	$0.06-$0.07	$0.10-$0.11
340 to 510	$0.10-$0.13	$0.13-$0.16

c. W. W. Aultman—Wat. & Sew. Wks., Vol. 105, Ref. No. p.R-214 (1958)—has estimated the savings per year for a family of three when a water is softened from a hardness of 300 to 500 mg/L down to 85 to 100 mg/L.

(1) Aultman's data are:

Use	Saving/Year/Family
Laundry alone	$ 4.68 to $ 9.36
Laundry + toilet + kitchen	$ 7.00 to $14.00
Laundry, toilet, kitchen + savings on plumbing maintenance, fabric wear, etc.	$14.00 to $28.00

(2) If the cost of municipal softening runs from $0.06 to $0.07 per 1000 gal, then for each family per year, the cost of softening would be from $4.60 to $10.73, clearly less than the savings for each family using a municipally softened water.

2 . . Municipal vs Home Softening

a. Dr. T. E. Larson, Asst. Dir., Illinois State Water Survey, has reported on the relative cost of municipal vs Home Softening—JAWWA, 45, 557 (1953). His data are shown in Table 4.

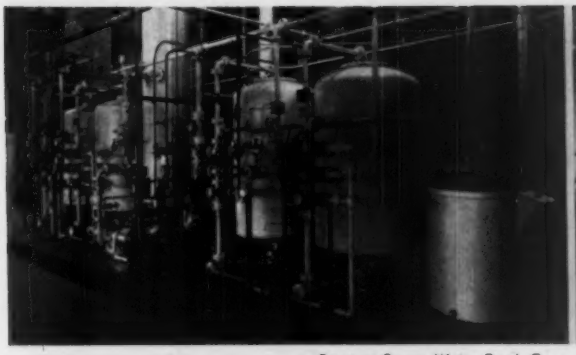
Table 4

Comparison of Municipal vs Home Softening Costs per 1000 gal

Hardness of Raw Water (mg/L)	85	250	340	510
Municipal Softening (Final hardness 85 mg/L)	——	$0.20	$0.27	$0.40
Salt for home owned softeners*	$0.10	$0.30	$0.40	$0.57
Serviced home softening	$1.00	$1.75	$2.30	$3.40
Soap	$0.26	$0.58	$0.76	$1.08

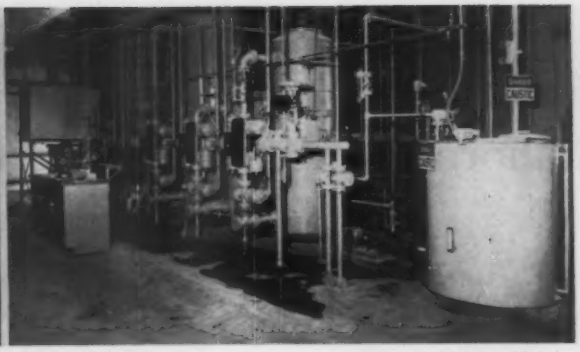
*Not including amortization costs

*p. 399, Sept. 1957



Courtesy Graver Water Cond. Co.

TYPICAL manual demineralizing system of type used by municipalities.



Courtesy Infilco, Inc.

FOUR-BED single line demineralizing system at No. Omaha Power Co.

(1) The data in Table 4 indicate that municipal water softening is cheaper, even when further softening to practically zero hardness is done by household type softeners.

(2) Dr. Larson also presented a table on the distribution by family income bracket, of home softeners of the rental type. These data show that families with low and medium incomes are benefited more by municipally softened water than are families of high incomes.

. . . Soft water service customers benefit from municipal softening because the major portion of hardness is removed as well as iron, manganese, etc., and the softening runs between regenerations of the unit are increased.

3 . . Lime Softening vs Ion Exchange

a. The choice between lime-soda softening and cation-exchange depends on many factors.

(1) Amount and relative types of hardness in the raw water.

(2) Turbidity and bacterial quality of the water.

(3) Available place for disposal of lime softening sludge.

(4) Cost of salt, lime, soda ash. . .

b. The cost of lime-soda softening depends on the type of hardness. For example, calcium bicarbonate is less costly to remove than magnesium carbonate, and bicarbonates are removed at less costs than noncarbonate hardness.

c. The cost of lime to remove bicarbonate hardness only is about half the cost of salt for cation-exchange, but the cost of salt to remove noncarbonate hardness is only about 80 percent of the cost of soda ash.

d. Aultman (see reference above) estimated the cost of softening to be from $0.03 to $0.07 per 1000 gal, and stated that in one lime-ion-exchange plant (hardness reduced from 360 to 140 mg/L) the cost was $0.028 when the salt cost was $0.0265 per lb.

e. Manufacturers of cation-exchange equipment estimate, on a rough basis, for a water of 250 to 300 mg/L hardness, that the salt requirement is 4 lb/1000 gal; at a cost of salt of $0.01 per pound, the cost of softening is $0.04 per 1000 gal.

4 . . Demineralization

a. The basic cost of demineralizing water by cation- and anion-exchangers, depends on the chemical content of the raw water, the equipment required, size of installation, and cost of regenerating chemicals.

(1) The operating cost can be calculated, if these data are known: Total cation content of water in grains per gal (as $CaCO_3$); regenerant dosage in lb per cu ft; and capacity of the resin in kilograins per cu ft, and cost of regenerant

Use this formula:

$$\frac{\text{lb acid/cu ft}}{\text{kgr/ cu ft}} \times \text{gr/gal cations} \times \text{c / lb acid} = \text{c /1000 gal}$$

(2) For a water of varying hardness (as $CaCO_3$) the cost of operating is shown in Table 5.

5 . . Saline Water Conversion

a. The cost of converting saline or brackish water to a usable supply depends on type of treatment, salt content of raw water, cost of power, etc.

b. S. T. Powell—Wat. & Sew. Wks., 106, 84 (1959)—estimates operating costs as follows:

Treatment	Cost/1000 gal
Solar stills	$2.00
Evaporators (sea water-present)	$2.00-$3.00
Evaporators (sea water-future)	$0.30-$0.60
Freezing (500 mg/L)	$1.00
Electrodialysis (4000-5000 mg/L)	$0.29-$0.50

Table 5

Cost of Demineralizing Water

Hardness mg/L	Strongly Basic Resin Regenerant Dosage		Cost/1000 gal		Weakly Basic Resin Regenerant Dosage	Cost/100 gal
	H_2SO_4	HCl	H_2SO_4	HCl	Na OH	Na OH
100	2.0 lb	4.6 lb	$0.04	$0.092	0.85 lb	$0.036
200	4.0 lb	9.2 lb	$0.08	$0.184	1.7 lb	0.072
300	6.0 lb	14.0 lb	$0.12	$0.28	2.6 lb	0.112

G . . . References

AWWA—"Manual of Water Quality and Treatment," 2nd Ed., Chap. 13, (AWWA, New York City)

Buswell—"Chemistry of Water and Sewage Treatment" Chap. 7 & 8, Chem. Cat. Co., New York City)

Fair & Geyer—"Water Supply and Waste Water Disposal" Chap. 23, (John Wiley & Sons, New York City)

Hoover-Reihl—"Water Supply and Treatment" 8th Ed., Chap. 9, 10, 11, 13, 14 (National Lime Assn., Washington, D. C.)

Nordell—"Water Treatment for Industry and Other Uses" Chap. 13-16, Reinhold Publ. Corp., New York City)

"Permutit Data Book"—(Permutit Co., New York City)

"Handbook of Demineralization"—(Cochrane Corp.)

Continuous flow, metered aeration, controlled solids wastage and known hydraulic loadings can be incorporated in . . .

Laboratory Units *for bench scale studies*

by A. W. BUSCH, Assistant Professor
Department of Civil Engineering
Rice Institute, Houston, Texas

RESUME: Bench scale experimental data often do not agree well with pilot plant or full scale results. This disparity may be at least partially attributed to differences in process environment. Bench scale experiments can yield valid design data if process variables are controlled.

A brief discussion of the desired characteristics of a bench scale unit for the study of biological oxidation shows that if process variables are to be properly evaluated, the following should be provided:

1. Continuous flow for uniform organic loading.
2. Metered aeration.
3. Positive suspended solids control.
4. A hydraulic loading similar to full scale requirements.

A bench scale unit, developed at the Rice Institute, embodying these characteristics is described in this article. Precautionary comments are also included. The brief description of the unit and its advantages over similar devices should be useful to other investigators and of interest to all persons in the waste disposal field.

■ THE DIFFERENCE between results obtained in bench scale and in prototype equipment or even between bench scale and pilot plant units may be partially attributed to changes in the physical-chemical environments provided in the various devices.

Environmental Factors

The desired characteristics of a bench scale unit include continuous flow, measured aeration, means of controlling suspended solids concentration and a hydraulic loading similar to that existing in full scale units.

Aeration

The common practice in reporting bench scale tests is to say "air was provided in excess" whereas in prototype and often in pilot plant studies, consideration is given to economics and investigators stringently control the amount of air supplied to the biological cultures. Since valid laboratory investigations also require the independent control of process variables it would seem reasonable to attempt to provide the same amount of oxygen per unit of volatile solids (or some other parameter) if consistent ORP environments are to be maintained in the various treatment units. Metering of the air supply is essential to maintenance of the desired ORP or dissolved oxygen level.

Organic Loading

A uniform organic loading is important if the most efficient steady-state food-culture equilibrium is to be established.[1] Certainly the once-a-day batch feeding method commonly used in activated sludge studies is not conducive to establishment of steady-state high level activity of all components of the complex system involved in biological metabolism of organic substrates. If valid loading data which require the maintenance of a uniformly active culture are to be obtained a continuous feeding system must be provided. Other investigators have recognized this requirement.[2]

Waste Mixed Liquor Control

The importance of positive control over volatile suspended solids maintained in a treatment system has been pointed out by Garrett.[3] In order to study the effects of variable loading and sludge age on the reactive capacity of biological cultures, provisions should be included for positive wastage of mixed liquor. Such controlled wastage permits varying the growth rate and hence, for a given loading, the effluent BOD, as discussed by Garrett.[3]

Hydraulic Loading

Probably the most divergent factor between prototype, pilot plant and bench scale studies is the hydraulic loading. At some installations full scale process difficulties are due to inability of the sludge developed on the waste to withstand the demands of the "conventional" surface loading applied. Usually these laboratory or pilot plant studies had low or non-existent hydraulic loading requirements and did not stress the settling characteristics of the culture. Such cases are most frequently encountered in the treatment of soluble organics. The culture developed on soluble wastes may have a very low specific gravity since the advantage of other suspended matter is often lacking. Here it may be found that increasing or decreasing the sludge age will produce a culture with better settling characteristics. Certainly, the desira-

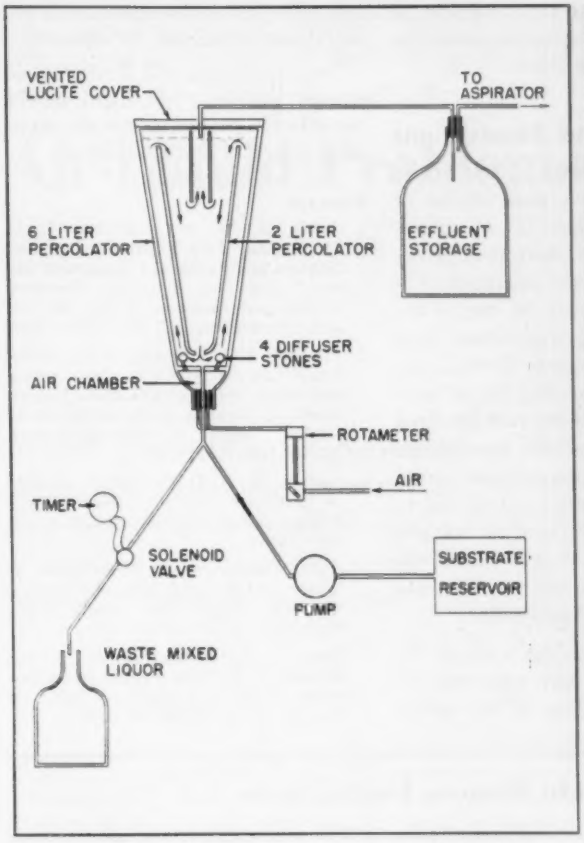


FIG. 1—SCHEMATIC of Bench Scale Bio-oxidation Unit.

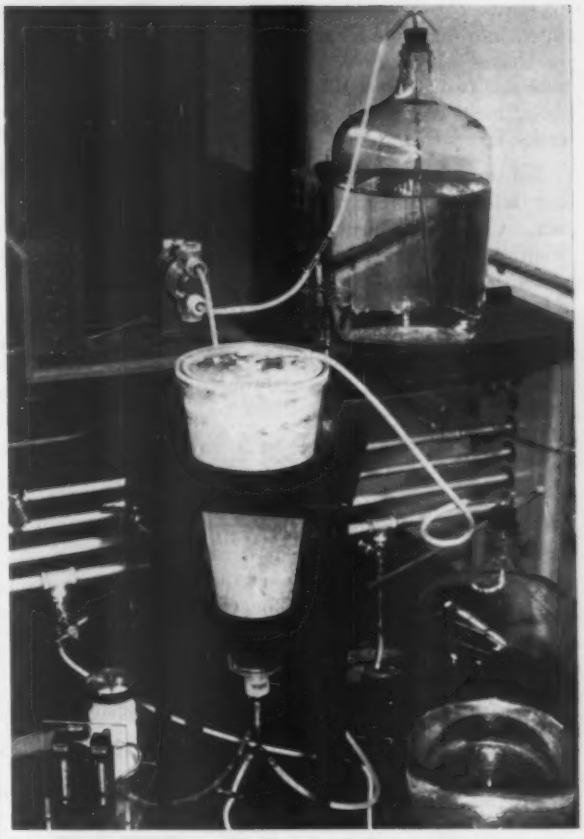


FIG. 2—BENCH MODEL of bio-oxidation unit illustrated.

bility of flexible control of sludge age and hydraulic loading in bench scale equipment is again indicated. One difficulty in hydraulic scale-down is, of course, the need for changing the shape of the treatment unit as the desired flow values decrease. This involves loss of the usual ratios of depth to basin area. Hence, more exact control of the hydraulic loading is frequently sacrificed in order to maintain the more accepted but not necessarily the desired physical relationships.

Design Considerations

Sampling and System Volume

One important consideration in the design of bench scale units is provision of a sufficiently large volume of culture to permit withdrawal of samples without appreciably affecting the food-solids balance. It is felt that the minimum size sample required for valid analysis[4] should represent not more than one per cent of the mixed liquor volume. For example: if 50 ml of mixed liquor are to be used for suspended solids analysis then the system should contain 5 liters. This limitation should not apply, of course, if analyses can be performed on wasted mixed liquor or the effluent. Mixed liquor withdrawn for a 30 min settling test should be returned to the system.

Pumping

Continuous transfer of small flows presents a problem. This has been solved by several ingenious devices[5] such as the use of an industrial chemical pump known as the Chlor-O-Mite.*

Effluent Withdrawal

In bench scale work flows are generally so small that weirs do not operate satisfactorily. This is particularly true where very low hydraulic surface loadings are used. A far more satisfactory procedure is the use of an aspirator for maintenance of liquid level and for effluent removal. This device permits trapping of the effluent for subsequent composite analysis.

Mixed Liquor Wastage

The control of mixed liquor solids concentration is best effected by wasting an amount of mixed liquor equivalent to a constant percentage of the throughput flow, as discussed by Garrett.[3] In constant rate units the use of a timer actuated solenoid valve to periodically withdraw the desired amount of mixed liquor is quite satisfactory.

Bench-Scale Unit

Figure 1 shows a schematic drawing of the components of the continuous flow unit developed at the Rice Institute. The basic housing is a 6 liter capacity percolator tube with a 2 liter percolator suspended inside to provide concentric recirculation pathways. A lucite disc fitted with four porous stone diffusers and an influent tube is cemented in the lower portion

*Proportioneers, Inc., Div. of B-I-F Industries, Inc.

of the percolator. A wooden plug is fitted into the bottom opening of the percolator and carries the influent tube and two air inlet tubes. A cylindrical lucite tube serves as the clarification compartment.

Substrate is pumped from the reservoir into the recirculating mixed liquor. Clarified effluent is aspirated from the surface of the sedimentation chamber. Mixed liquor is wasted cyclically through the influent tube connection and is controlled by a solenoid valve. Air is metered and flows into the air chamber and thence through the stone diffusers.

The total volume of the unit is fixed, of course, and hence detention time is varied by changing the throughput rate. Since the concentration of substrate may also be varied, a wide range of organic loadings can be studied. The surface loading can be held constant by simply changing the diameter of lucite tubing used as the clarification compartment whenever the throughput rate is varied.

Figure 2 shows a photograph of the operating unit complete except for timer and solenoid valve.

Precautions and Reservations

It is not the intent of this article to infer that bench scale studies of biological oxidation is a simple, straightforward or short time procedure. The successful operation of a bench scale unit may be one of the most exasperating experiences ever encountered. Leaks may develop, tubing and pumps may clog, the air supply may fail — and the time involved may stretch on and on. In addition, some features of process scale-up do not permit straightline extrapolation. Certainly the difference in oxygen transfer in 2 and 15 ft of depth will be marked. Thus, air requirements must be established indirectly.

Slime growths on the walls of the bench scale unit may represent an appreciable percentage of the active culture in low solids experiments and are almost impossible to measure.

The investigator will inevitably encounter problems not listed herein, but effective studies require the maximum control of process variables.

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Water Evaporation Losses In Western United States

The Department of the Interior has reported that "enough water is lost every year by evaporation in the 17 Western States to supply all the towns and cities of the country."

A preliminary report by the Geological Survey estimates that more than 21 million acre-feet of water is evaporated annually from the water surfaces of fresh-water streams, lakes, canals, ponds, and reservoirs in the

J. Stuart Meyers, hydraulic engineer, United States Geological Survey, is making a study of evaporation from fresh-water surfaces in the 17 Western States. This is one phase of a study of the savings that might be made by reducing evaporation losses in areas where water is in short supply.

The accompanying table shows annual evaporation losses for the 17 Western States. Losses from the portions of stream channels and reservoirs that form the boundary between States or Nations are listed separately by river name. These losses are not included in the State totals. All figures are in acre-feet per year.

State or boundary river	Large lakes & reservoirs (more than 500 acres)	Principal rivers	Small lake, reservoirs, and streams	Totals
Washington	683,000	487,000	80,000	1,250,000
Columbia River	173,000	372,000	.....	545,000
Oregon	503,000	101,000	100,000	704,000
Snake River	.....	106,000	.....	106,000
Idaho	968,000	248,000	84,000	1,300,000
Montana	1,188,000	272,000	143,000	1,603,000
Wyoming	431,000	71,000	85,000	587,000
Colorado	208,000	83,000	120,000	411,000
Utah	390,000	161,000	63,000	614,000
Nevada	538,000	3,000	30,000	571,000
California	1,352,000	202,000	203,000	1,757,000
Colorado River	1,135,000	230,000	.....	1,365,000
Arizona	94,000	209,000	119,000	422,000
New Mexico	192,000	35,000	81,000	308,000
North Dakota	991,000	68,000	415,000	1,474,000
Red River of the North	46,000	7,000	.....	53,000
South Dakota	1,207,000	97,000	260,000	1,564,000
Minnesota River	26,000	.....	.....	26,000
Big Sioux River	.....	6,000	.....	6,000
Missouri River	37,000	369,000	.....	406,000
Nebraska	210,000	392,000	429,000	1,031,000
Kansas	192,000	268,000	217,000	677,000
Oklahoma	394,000	352,000	234,000	980,000
Red River	331,000	125,000	.....	456,000
Texas	1,148,000	406,000	633,000	2,187,000
Sabine River	188,000	22,000	.....	210,000
Rio Grande	362,000	139,000	.....	501,000
17 Western States	12,987,000	4,831,000	3,296,000	21,114,000

New Jersey S&I W A

Continuing the practice of devoting the first day of the annual meeting exclusively to industrial waste produced interesting paper on

Air-Liquid Problems, Solids Behavior

A Meeting Report by
FRED C. MAURER, Managing Ed.

EDITOR'S NOTE: This year the meeting was held immediately following the Mid-Atlantic States Section Air Pollution Control Assn. technical conference, thus covering the air pollution problems, as well as liquid and solids waste fields. Some of the papers are briefly highlighted in this report.

INTER-RELATIONSHIP BETWEEN AIR AND LIQUID POLLUTION PROBLEMS, by William H. Lang, Pollution Control Advisor, Esso Research and Engineering Co.

As has been noted many times before, one of the basic problems facing industry with multiple plant installations today is the variance of government controls in different areas. Most of the controls, as they stand today, are concerned with the pH of the waste. They do not take into consideration air pollution or odor problems.

In order to try and overcome some of these various regulations, some refineries are now adopting air as a cooling medium rather than water, thus eliminating the waste water problem.

It should also be pointed out that the public health aspects of air pollution have not received the particular attention that water pollution has. Water pollution, in all its aspects will be the world's largest industry.

One of the main problems in the control of air pollution is that air cannot be treated and distributed like water, plus the fact that sometimes the correction of a liquid waste problem creates an air pollution problem. In addition, the need still remains for proper sampling techniques to be developed and stabilized for both air and water pollution.

In the field of public relations, there is absolutely no boundary between air and water pollution. Therefore, any accomplishment in solving either an air or water pollution problem should be profusely advertised and publicized.

POLLUTIONAL EFFECTS OF SOLID PARTICLES ON SURFACE WATER, by Sylvan C. Martin, New England Regional Engineer, U. S. Public Health Service.

The three types of solids, settled, suspended and dissolved present us with four types of general problems. 1. The problems of unsightliness, aesthetic and ordorous effects. 2. Hazards to navigable water by changing of stream or harbor bottoms. 3. The formation of hydrogen sulphide gasses. 4. The destruction of commercial values of shore front properties.

It was also pointed out that high solids content prevents the destruction of pathogenic organisms in water.

Mr. Martin, in citing several instances of expensive problems encountered by industry, and the importance of adequate and qualified supervision of the waste treatment processes, told how one stuck valve cost a company $500,000. The stuck valve caused the discharge of untreated waste solids and caused the State Stream Pollution people to force action for new equipment, etc., and suspended company operations until the situation was corrected.

PHYSICAL AND CHEMICAL BEHAVIOUR OF SUSPENDED SOLIDS, by Richard D. Hoak, Senior Fellow, Mellon Institute of Industrial Research.

Prefacing the paper with the statement that there are no criteria for deciding the unreasonable impairment of streams by solids, Mr. Hoak posed a number of questions that are currently plaguing the water pollution control industry.

Since photo synthesis is the basis of all activity, it was thought that light penetration studies may provide some answers, but these have so far failed to produce any criteria for the effect of solids on photo-synthesis.

It was also pointed out that knowledge is quite limited on the effect that inorganic settled solids have on bottom organisms other than mechanical smothering.

Further information is badly needed on the depth effect of inert settled solids. Especially data on how depth affects the mortality rate of bottom organisms. And, as the depth increases, at what rate does the diminishing sunlight slow the photo synthesis action?

Tests should be conducted to establish at what point the load settled solids becomes so heavy that the spring freshets cannot re-suspend the fine solids. Today there are no standards set or information available on the concentration effects of solids below the obvious overloads, no rate of discharge of solids can be ascertained.

To carry the above one step further, determinations should be made

as to what silt concentration must be reached before having a deleterious effect on fish life.

At the present time there is no available information on whether industrial solids are being effectively or sufficiently removed, before being discharged into a receiving stream or body of water.

The Mellon Foundation now has under operation, a complete long-range study program on the solids problem, and some of the first indications show that previous studies may have been overly concerned with oxygen demand.

SEDIMENTATION, DESIGN AND OPERATION by W. E. Dobbins, Professor of Engineering, New York University.

Sedimentation is the most widely used process in the separation of solids and liquids. The sedimentation process is not concerned with changing natural laws, but rather one of creating more favorable conditions than exist in nature for the phenomena to occur.

Hydraulic elements in sedimentation cannot always be controlled, and also, the sedimentation rate does not increase with increased flow.

One of the main points considered today in the design of settling tanks can be broken down as "over-flow vs. detention period". The fact that the detention period has no meaning for discrete particles must also be taken into consideration.

Mechanical floculation can operate just as efficiently in a small or shallow tank as in deep tanks, however it must be remembered in the design of tanks, the rate of turbulence has an effect that is difficult to ascertain precisely. It has also been proven that long-narrow tanks provide more efficient sedimentation.

An ideal settling tank design would include a diffusing wall at the inlet end, but this would also tend to gather solids in it. In the settling of discrete particles, the most single important consideration in design is the overflow rate.

GENERAL PRINCIPLES OF CHEMICAL COAGULATION by M. C. Rand, Chief Chemist, Middlesex County Sewerage Authority.

It is a general rule-of-thumb, that chemical treatment is indicated where primary treatment facilities do not have sufficient effect on the effluent.

For purposes of chemical coagulation, colloidal size particles are the most easily coagulated. In normal effluents, the composition of the particles can usually be determined and thus easily treated. However, in industrial wastes, there is no idea of the particular composition of the particle to be removed, thus complexing the problem.

In chemical coagulation, particles of the same type and size have like electrical charges and so tend to repel or resist agglomoration. This is overcome by the positive or negative charge of the chemical to be used in coagulating the particles.

It is not known at the present time, what effect changing the composition of the particles to be coagulated will have on the process at plant level.

The two basic steps upon which all chemical coagulation processes are based upon are: 1. Proper chemicals must be put into the waste to be treated, and 2. Flocculation must follow this stem. Usually one chemical will cause coagulation, however sometimes coagulant "aids" are used to provide neculi for floc, thus increasing the coagulation functions of the basic chemical coagulant. This is used quite often for pH adjustment.

In summary, each waste must be tried out, and the best coagulant found for that particular waste from the viewpoint of economy and efficiency of that chemical. This can become a rather lengthy procedure as there are over 15 different factors that have some effect on the selection of proper chemical treatment.

Plant tests should also be made after it is put into operation. Operations should be started as recommended by previous laboratory experiments. Then if this procedure is not producing the completely satisfactory results, it is suggested to run the entire plant operation as a laboratory test run by varying the original laboratory recommendations. Run each variation for at least a 10 day or two week period if immediate results produced are not obviously destructive or bad, until proper solution is found.

LABORATORY CONTROLS FOR SMALL PLANT OPERATORS, by Leroy Forman, Principal Public State Health Engineer, N. J. State Dept. of Health, and Robert Arnette, Ass't. to the Supt., Bergen County Sewerage Authority.

Lack of laboratory controls will definitely adversely affect operations if allowed to continue. However, laboratory control seems to suffer from the more common ailments particular to this field in general—advantages not immediately apparent, lack of personnel, lack of training available, etc.

It was noted that while Standard Methods has done an excellent job, it was written and designed for the larger, better equipped laboratory, plant and chemist. At the lower level, operators lack of formal training presents a handicap; this plus the fact that it is almost impossible for one man to devote time to running the plant and do the sampling necessary, even minimum grab sampling.

Today, operational records of the laboratory are as important to the job as are flow data or maintenance.

When a plant is being built, it is suggested that the budget be "beefed-up" to include additional pieces of equipment that will become necessary, even if the operator then might not know the exact use of each piece, rather than have the handicapped operator try to get additional money and equipment after the plant is put in operation. This might enable him to get the piece of equipment that would be the most suitable for the job rather than having to take something else and adapt it thus consuming more time.

RADIOACTIVITY, A SOURCE OF POLLUTION by Robert J. Budrick, Principal Sanitary Engineer, Jersey City Water Works.

It must always be remembered that radioactivity cannot be treated a normal waste. There are currently four main sources of radioactivity in wastes: 1. Naturally occurring, such as from mining; 2. Isotopes used by industry, exposures can occur; 3. Nuclear reactors; and 4. Nuclear weapons fall-out.

It is of a general opinion that something like 51 percent of the isotopes used by hospitals somehow end up eventually in the sewers.

Interest should be created and the sewage plant operators should be all well alerted to the possibilities of radioactivity, and some basic method of detection presented.

Southern California ponders present and future . . .

Marine Pollution

by DONALD J. REISH and J. LAURENS BARNARD
Dept. of Biology and the Allan Hancock
Foundation, Univ. of Southern California

RESUME: The purpose of this article is to summarize the amount, type, and effects of waste discharges entering the marine waters of southern California. Waste discharges are defined as any water masses which have been utilized by man; excluded is freshwater run-off originating from rains.

Attention to this problem is warranted on the basis of (1) the rapidly expanding population, (2) the greater importance of industry to the economy of the area, (3) the absence of major rivers which act as receiving waters in the area, and (4) the decline of the general attitude that the ocean is large and can receive an infinite quantity of wastes. It is a report on background data upon which future studies and policy may be based.

This study was supported in part by research grant from the National Institutes of Health, United States Public Health Service. It is a contribution from the Hancock Foundation.

■ THE STUDY of marine pollution has been intensified in recent years, but most of the biology studies are concerned primarily with the description of conditions as they exist. Generally speaking, environmental surveys are not undertaken until the state of pollution does exist. Thus, the literature lacks general background information on biological and oceanographic conditions prior to pollution. It is this background data which is being accumulated for the southern California marine area.

Oceanography

The coastal waters of southern California are under the major influence of the relatively cold, southward flowing California current. Due to the offshore islands and submarine ridges, which are oriented generally northwest to southwest, the current makes a large northeasterly swing, then turns southward again. This affects the entrainment of surface waters which are drawn offshore bringing colder deeper waters to the surface. Upwelling of major proportions is especially apparent in the Straits off Santa Barbara. Seasonal northwesterly winds tend to increase this upwelling, but erratic wind movements throughout most of the year affect those inshore waters less than 300 feet in depth, causing very complex movements of the upper sea layers.

Currents have been measured by various means in Santa Monica Bay and are very slow, about 0.2 knots.[1] Eastward moving waters are deflected by the coastline of the bay to produce both northerly and southerly directed longshore currents at either extreme, but again these currents are slow, with low flushing rates of the bay. Prediction of movements of sewage fields is still hampered both by a lack of data and an understanding of the effects of hydrographic and meteorological causes.

Density currents due to run-off of freshwaters from land rarely occur, except for those periods of several days once or twice during the heavier winter rainfalls. Coastal rainfall averages about 14 inches per year.

The inshore water mass of about 20 square miles in Santa Monica Bay has slightly lowered salinity (32.9 to 33.4 ppt). This area is governed mainly by the discharge of sewage from the Hyperion outfall.[1] Otherwise the coastal shelf waters of southern California are normally saline (33.5 ppt).

Fisheries

The San Pedro Harbor area is the largest commercial fish port in the world, landing and receiving shipments of between $35 to $45 million of fish a year.[2] However, more than half of the catch is in the pelagic and extraterritorial fisheries such as tuna, which are caught mainly in waters south of California. San Diego is the largest tuna port in the world.

The value of fish landed in California in 1956 was $71 million and amounted to 386,000 tons, but in 1936 the peak was 882,000 tons. The recent drop is due to the missing sardine. Roughly a third of the tonnage was caught in southern California waters in 1956. Another 6,500 tons of live bait were caught in southern California. About 3 million marine fish are caught by sportsmen in California which represents over 500,000 fishing man days.

Recreation

Despite the fact that inshore surf waters are rather cold (about 60 to

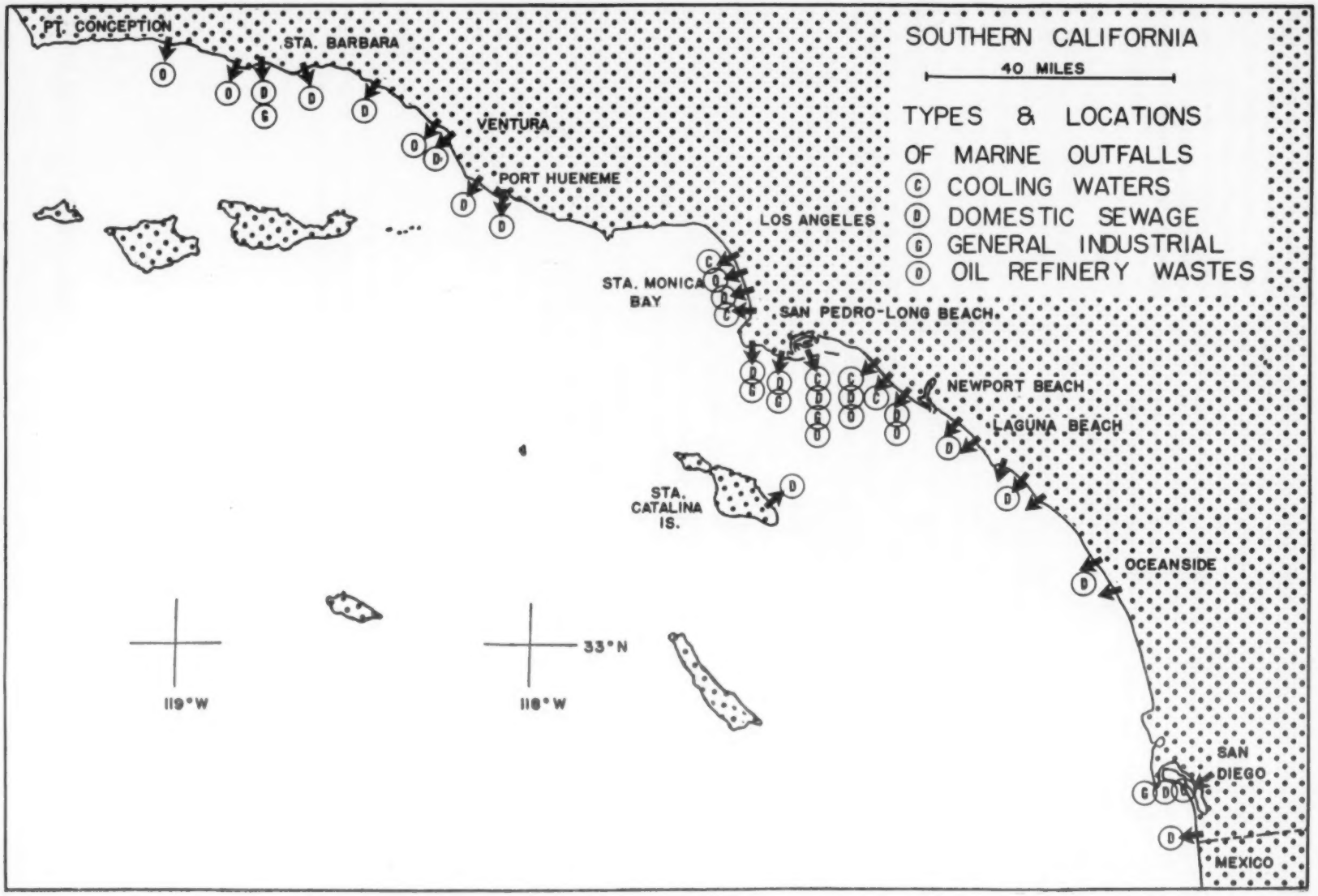

FIG. 1—GENERAL TYPES AND LOCATIONS of marine outfalls in southern California.

70°F in the summer) and discourage many bathers, beaches near metropolitan centers are densely crowded during warm summer weekends. Many boat harbors, such as those at Santa Barbara, Santa Monica, Los Angeles — Long Beach Harbors, Alamitos Bay, Newport Bay, Mission Bay, and San Diego Bay, support a large year around recreational outlet. More than 19,000 registered pleasure craft berth in southern California, a hobby amounting to a $50 million per year business. These figures do not include the smaller craft which are transported to the ocean on trailers.

Population

The rapid population growth of California in general and southern California in particular is well known. The five counties bordering the ocean in southern California had a combined population of over 5 million in 1950, of which about 80 per cent lived in Los Angeles County. However, the number of residents has increased considerably since the 1950 census, and the southern California area is envisioned to be a city of 200 miles in length by 1975[3]. It is apparent that greater amounts of wastes will be emptied into the area, while even greater demands are made upon the recreational facilities of the ocean.

Effect of Waste Discharges

A total of about 3240 mgd of domestic and industrial wastes are emptied daily into the ocean off southern California (Figure 1 Table 1). Domestic wastes include raw sewage, septic tank effluents, and primary or secondary sewage treatment plant discharges. A minimum total of nearly 800 mgd of domestic waste is emptied into the marine waters, the majority of which is discharged at Hyperion and White's Point in Los Angeles County.

The greater percentage of wastes emptied into southern California waters is industrial in nature and of this over 90 per cent is cooling waters largely derived from steam generating plants (Table 1). Oil refinery wastes are the second most important industrial discharge in terms of the amount of waste. The remaining 71 mgd of industrial wastes include discharges from a host of different manufacturing and processing plants.

Table 1

Types and Amounts of Wastes Discharged Daily into Southern California Marine Waters*

Type of Discharge	Amount of Discharge (mgd)
Domestic Sewage	798.55
Cooling Waters	2,290.51
Oil Refinery Wastes	79.32
Other Industrial Wastes	71.21
Total Discharge	3,239.59

* Data compiled from references 7, 12 and 13 and from information supplied by the executive officers of the four regional water pollution boards located in southern California. Figures represent minimal amounts.

The effects of the different industrial and domestic discharges are readily noted in those regions where the exchange with ocean water is retarded, such as bays or harbors; or where the amount of discharge is very large, such as the Hyperion or White's Point domestic outfalls. No measurable effect on the marine environment is noted in those areas where the currents are favorable for rapid dispersal of the pollutants or where the amount of discharge is small.

Most of the coastal outfalls discharge into shallow waters less than 120 feet in depth; in areas where coarse sediments such as sands or shells predominate. It has been shown in Santa Monica Bay near the Hyperion outfall[1] that the settleable matter in the effluent enriches the bottom animal life, normally sparse on such bottoms. Near White's Point outfall where bottom depths are less than 120 feet, large quantities of tube worm and nestling clam occur more abundantly than at other parts of the coast. At depths greater than 180 feet the bottoms are composed of black muds supporting little marine life, which is abnormal. Thus, in varying degrees outfalls may kill bottom life, enrich it or alter the normal animal populations.

The majority of the steam generating plants are located on the coastline and discharge cooling waters directly into the ocean. Since these plants have long pipelines extending into the ocean, the warm waters are usually cooled to the temperature of the surrounding water mass during passage through the outfall pipe. The chief danger is in discharging cooling waters at high temperatures.[4] A major share of the 1250 mgd of wastes discharged into Los Angeles-Long Beach Harbors is cooling waters from steam generating plants and other industries. The only measurable effect of these discharges occurs in the West Basin of Los Angeles Harbor where the temperature of the basin waters is raised 5 to 8°F above normal at a distance of about 3000 feet from the outfall.[5] Studies[6] on the attachment of fouling organisms onto wood test blocks in the vicinity of the outfall showed little biological effect on these warmer waters.

Approximately 60 mgd of oil refinery wastes are emptied into the inner reaches of Los Angeles-Long Beach Harbors. The bottom of the slips or basins which receive these wastes are covered with a black sludge and are either devoid of animal life or nearly so.[7,8,9] Oil refinery wastes are emptied into the ocean directly at many other localities of southern California but in much smaller quantities; there is no evidence that these discharges have affected the marine life in the area. However, natural oil seepages occur in the region west of Santa Barbara and under calm sea conditions an oil slick has been observed to have killed large numbers of floating jelly fish.

Other regions where poor mixing of inshore water and marine life is affected include the Fish Harbor region of Los Angeles Harbor[8,10] a slip of Newport Bay,[10] Lower San Gabriel River[11] and San Diego Bay.[12] The former two areas receive fish cannery wastes; fish scales have covered the bottom and have killed or excluded most of the marine organisms. The latter two areas receive industrial wastes of various types, cooling waters and domestic sewage; their bottoms have been altered by these discharges.

Marine Pollution Research

The majority of the marine areas which have been affected in southern California are located in bays and harbors and in the vicinity of large offshore domestic outfalls. However, the problem will become more widespread in the future because of the pressure caused by the increase in population. At the present time most

of the wastes originate from Los Angeles County, but the metropolitan area is expected to extend approximately 100 miles in either direction within 20 years, therefore the other areas will become affected. The question arises whether the increase in the number of marine outfalls to handle the expansion of population and industry conflicts with the recreational uses of the beaches and waters of southern California.

Marine pollution investigations have lagged behind fresh water studies. Information is lacking on the effects of pollutants upon marine organisms, except spatial population studies. Unknown are such basic data as the tolerances of marine organisms to varying chemical and physical changes, such as dissolved oxygen and temeratures, and the relationship of pollution to the food of animals. The life histories and general ecology of most marine animals are virtually unknown. In one study a relationship between the species of polychaetous annelids and the degree or type of pollution, has been found to exist in different bays and harbors of southern California.[8,10] Undoubtedly this relationship will be found in other marine areas when more have been surveyed.

The State of California Water Pollution Control Board is supporting two projects which are measuring various aspects of the oceanic natural environment. One of these concerns the production of kelps and the influence of environmental factors on them, especially pollution. The other is a survey of the bottom dwelling plants and animals, the hydrography, and marine geology of the inshore waters along the 250 miles of coastline in southern California. This type of basic research is a considerable value in the planning of future waste discharging policies, and subsequent studies on specific and local outfall problems will have a fund of basic information on which to start. The effects of outfall sewers and steam generating plants on the hydrographic and biologic conditions of the sea, and standards for the beneficial uses of coastal waters can be determined from such studies. Conservation of fishing grounds and recreational beaches as determined for the present century must be considered and long-range planning for the eventual use of offshore waters for freshwater conversion and new kind of food supplies, perhaps a farming of the sea, must be taken into account. Coastal seas are a great resource, commercially, climatologically and recreationally. Any interruption of a normal physical and ecological cycle must be measured, monitored and controlled.

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Reading, Pa. Uses Prestressed Concrete Reservoirs

A pair of prestressed concrete reservoirs storing 27 mil gal of filtered water at Reading, Pa. are each 292 feet in diameter and can "flex their muscles" any time weather or water-content demands. The concrete walls were prestressed during construction to withstand extreme expansion and contraction caused by temperature and water-volume changes. As a further protection against such damage, the wall and floor of each tank were poured as an integral unit not anchored to the rubber base on which the tank rests. The roof, which lies on the circular wall like a flat lid, is supported by concrete columns.

Prestressed was accomplished by wrapping the walls with wire during construction. After pouring the wall, wire under tension was wound around the shell, thus multiplying many times the stress-factor of unreinforced concrete. Finally a one inch coating was sprayed over the wire to protect it from the elements.

REPORT FROM ABROAD

Both the British and American points-of-view were presented at the annual . . .

Institute of Sewage Purification Conference

by JOHN FINCH Manager
Sewage Disposal Department
Slough, England

EDITOR'S NOTE: A high standard of technical contributions, with the emphasis placed on industrial wastes keynoted the Institute's annual conference held at Southport, England.

Emphasis on the industrial waste problem was this year the keynote of the proceedings of the Annual Conference of the Institute of Sewage Purification held at Southport, and the emphasis came from more than one source for not only were the current British and American points of view brought out during presentation of papers and discussion of these papers, but the newly elected President chose to look into the future of industrial effluent treatment and disposal. The subject of industrial effluents is assuming greater importance at all meetings of the I. S. P., whether they be branch meetings or Annual Conferences, for the industrial effluent problem becomes more weighty every day and demands technical investigation and discussion.

The conference also included visits to Wigan and St. Helens plants which were of great interest.

The Conference programme followed the pattern of previous years and commenced with the reception given by The Worshipful the Mayor of Southport, Councillor Roland Wood, J. P., in the Floral Hall. This was a most enjoyable function and gave delegates some idea of the large numbers present at the Conference.

The President's Address

The President, Mr. W. H. Hiller, in his address covered a lot of ground and created a good deal of thought for he summarized the developments in sewage treatment over the past fifty years, discussed present day problems and difficulties, and finally speculated on the possible trends of the future.

Speaking of the future, the President quoted Sir Harold Hartley who said that "In some places water is becoming the limiting factor to development and in Britain it is already difficult to locate a new industry needing much clean water or to find inland sites with cooling water for power stations and industry. Here the engineer can help by the efficient treatment of effluents and sewage, by the re-use of water by means of cooling towers or by returning well water used for cooling to the strata from which it was drawn." The President said that for several years there has been a recurrent annual water shortage especially in the industrial midlands and south-east and that whilst water of high purity is essential for drinking purposes, lower grade water will often serve the needs of industry and sewage effluents will have to be used to an increasing extent, and that a national policy for the conservation of natural resources, including all aspects of our water resources and the use of sewage effluents, is needed.

Overseas Visitors

The newly elected President then introduced the overseas visitors and it was learned that delegates had come from many countries abroad including Russia. Two delegates of distinction were your own Professor Bloodgood and Dr. Heukelekian who were attending an Institute of Sewage Purification Conference for the first time, and no doubt finding it somewhat strange.

Report on U. S.

Professor Bloodgood of Purdue University—well known in the U. S., was enthusiastically welcomed when he took to the rostrum to present his Paper, "Treatment of Industrial Wastes in the United States."

Professor Bloodgood who introduced his paper with the theme that in the U. S. A. there was not enough water in the right place at the right time, stated in his paper that the decrease in the pollution of streams by industrial wastes has come about through co-operative efforts of government and industry. The governmental agencies have been directed in their efforts by laws instigated by the people of the U. S. and the industries have as individuals or as collective groups studied their problems, developed methods of treatment or elimination of wastes, and integrated the cost of the constructed facilities for waste treatment with other production costs so that there was no unfair competition in the markets.

He went on to say that the governmental groups that are charged with the responsibility of making sure that

industrial wastes are properly handled are: the Federal government of the United States; groups of states that have agreed-upon compacts; State governments; Sanitary districts that are groups of cities or other subdivisions of local communities, or Municipal governments.

The author then went on to describe methods of underground disposal of wastes; treatment of refinery wastes by dissolved air flotation; spray irrigation (now receiving some attention in Great Britain); ridge and furrow irrigation of dairy wastes, phenol recovery plants; industrial reuse of water, circulating lagoons and etc., and finished up with a note on the disposal of radioactive wastes.

A very lengthy discussion took place on Professor Bloodgood's paper in which it was noted that spray irrigation of cannery wastes was in operation in Kent, England, and that there was great interest being displayed in this method of disposal.

River Pollution Control

Perhaps the most important session of the whole conference was that devoted on Thursday morning to a symposium on the control of river pollution. Three papers were presented, "Standards: some Pros and Cons", by Martin Lovett, Chief Inspector, Yorkshire Ouse River Board; "Local Authorities and River Standards", by S. C. Evans, Manager, Luton Sewage Department, and "Chemical Manufacturers and Standards for Trade Effluents", by G. T. King, Technical Executive Officer, Association of British Chemical Manufacturers.

Mr. Lovett gave a well balanced introduction from the point of view of the River Board; Mr. Evans gave an introduction which was controversial, and Mr. King presented industry's side of the problem.

One thing was very apparent and that was the incontrovertible fact that the Institute of Sewage Purification and Industry must get together for the common good in solving and dealing with problems connected with the treatment of industrial effluents and the sooner the better.

As one delegate put it, the whole matter of control of river pollution is one of technical knowhow, appreciation of the problems, and compromise.

Recirculation in Filtration

Another important session was devoted to the presentation and discussion of the paper by Clarence Lumb and P. K. Eastwood of the Halifax Sewage Department, on "The Recirculation Principle in Filtration of Settled Sewage—Some Notes and Comments on its Application".

In their paper the authors described further experiences of a pseudo-recirculation process which confirmed that dilution of sewage fed to filter beds with purified effluent from aeration plants enables these beds successfully to handle over twice the sewage loading. They also said that trials on alternative methods of applying the recirculation principle to filtration of settled sewage, lead to the conclusion that best results are obtained when the ratio of recirculated effluent to sewage treatment is maintained over all rates of flow, in spite of the fact that results obtained were a little inferior with a steady rate of recirculation equal to the average flow treated, and that the discontinuance of recirculation in prolonged storms may give rise to ponding difficulties. Some observations were presented on the fundamental mechanism of recirculatory filtration, with indications that in this process, when compared with conventional filtration, the clarification and carbonaceous oxidation zone extends over a greater depth of the filter bed.

Dr. Watson of Keighley proposed the vote of thanks, and in doing so pointed out that recirculation was now making very good progress, whereas alternating double filtration was in the doldrums. He quoted the Keighley installation of recirculation which cost £2200 and saved capital expenditure of £25000. He did not however give any details of running costs. Points which arose in a very thorough discussion in which many took part were that recirculation aids settlement, lowers nitrate figure, and in general can be of great service to the biological filtration scheme not only from the point of view of loading, but also from the point of view of clean filter beds.

Plant Units

The visit to the Sewage treatment plant of the County Borough of St. Helens was well attended, in view of the fact that this is an ultra-modern scheme not only recently put to work, and one of the few in the North of England recently constructed, which includes diffused air activated sludge; power production from digester gas, and vacuum filtration. The vacuum filtration plant is one of but a handful installed in the country, and this installation very naturally created a lot of interest. The effluent from the St. Helens plant is used in part as cooling water for the nearby electricity board, the remainder discharging into Sankey Brook. On inspecting Sankey Brook, one could not help cogitating on a state of affairs which requires one authority—in this case the local authority—to face up to its obligations and cease polluting the Brook, whilst at the same time apparently allowing other authorities—many of them industries—to evade the issue.

Sankey Brook has been quoted as the most polluted river in the British Isles.

The population draining to the St. Helens plant at present is 125,000 and the d.w.f. is about 6 m.g.d. The scheme will deal with flows up to 3 x d.w.f. and 2.25 x d.w.f. of trade wastes, i.e. 16.5 m.g.d. to receive full treatment and produce effluents of Royal Commission standards. Flows in excess of 16.5 and up to 33 m.g.d. will receive screening and settlement before discharge, and flows in excess of 33 m.g.d. will receive screening only before discharge to the river.

A visit was made to the Hoscar sewage treatment plant of the Corporation of Wigan, which plant now in course of re-construction will comprise, primary sedimentation in radial flow tanks; biological filtration on circular filters with provision for recirculation or alternate double filtration of flows up to 2 x d.w.f.; sludge digestion and power production from digester gas.

It is interesting to note that experimental work extending for two years was undertaken in a pilot activated sludge plant, and whilst every effort was made to improve the low stability of the effluent and the poor settling characteristics of the sludge, the effort was abandoned. The unsatisfactory results were attributed to the presence of inhibitory wastes in the sewage and to the continuous septicity of the sewage arising from the peculiarities of the sewerage system. Attempts to control the septicity proved uneconomic.

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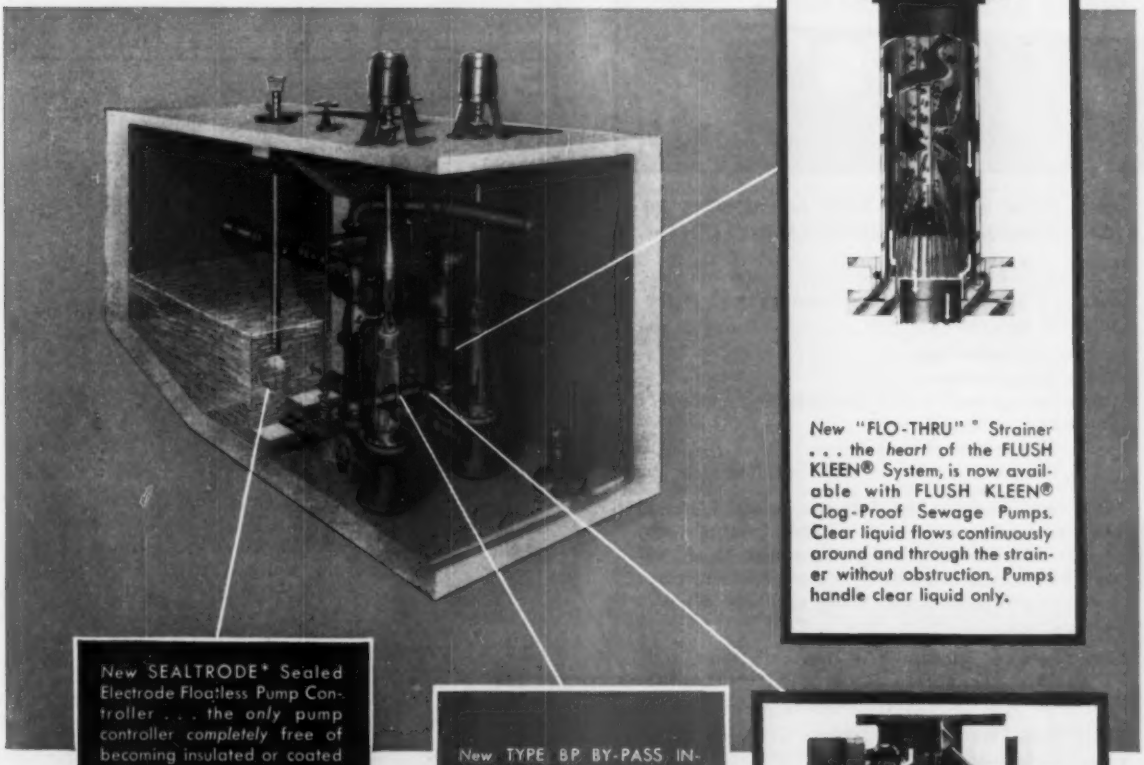

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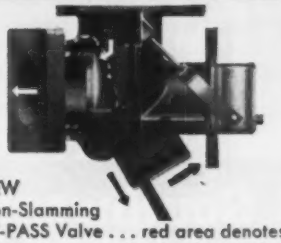

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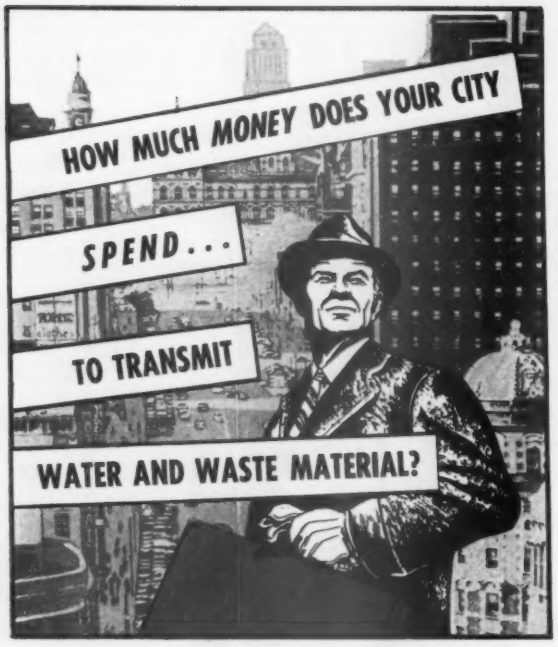

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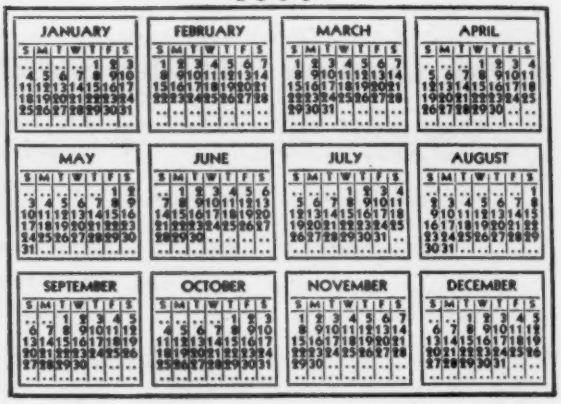


June 8-9—Ann Arbor, Mich. (*Univ. of Michigan*)
INDUSTRIAL WATER CONSERVATION COURSE, School of Public Health.

June 11—York, Maine
MAINE WATER UTILITIES ASSN., Secy., G. F. Laurin, 89 Western Ave., Augusta, Maine

June 14-17—Honey Harbour, Ont. (*Delawana Inn*)
6TH INDUSTRIAL WASTE CONF., Secy., D. S. Caverly, Ontario Water Resources Comm., East Block Parliament Bldg., Toronto, Can.

June 15-19—New York, N. Y. (*Manhattan College*)
FOURTH COURSE ON BIO-OXIDATION OF ORGANIC WASTES THEORY AND DESIGN, Prof. W. Wesley Eckenfelder, Civ. Engrg. Dept., Manhattan College, New York 71, N. Y.

June 16—Martinsville, N. J. (*Martinsville Inn*)
NEW JERSEY SECTION, A.W.W.A., Luncheon and Summer Meeting with Tour at Elizabethtown Water Co. and Golf at Raritan Valley Country Club, Somerville, N. J., Secy., Albert F. Pleibel, 683 Prospect St., Maplewood, N. J.

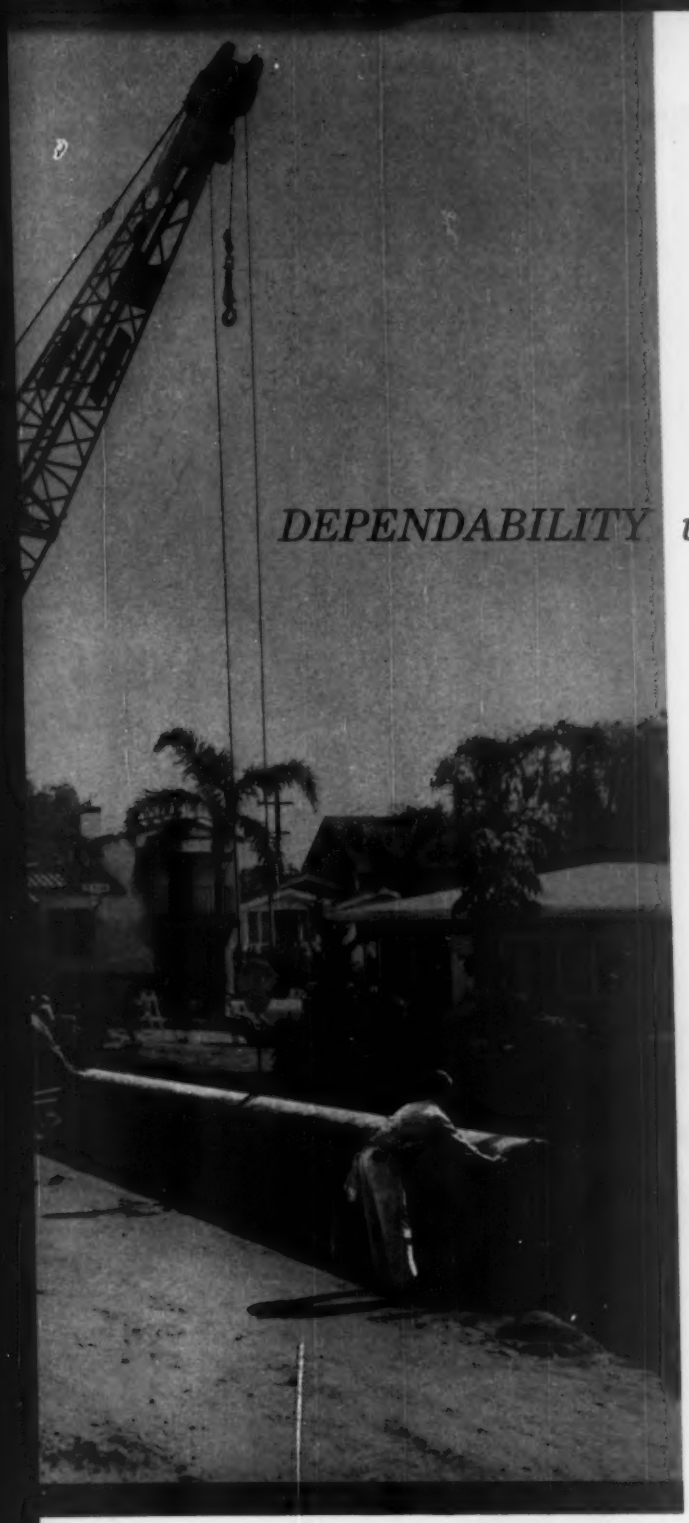
June 17-19—Cincinnati, Ohio (*Netherland Hilton Hotel*)
OHIO SEWAGE & INDUSTRIAL WASTES TREATMENT CONF., Secy., Cleamon E. Lay, Ohio Dept. of Health, 101 North High St., Columbus 15, Ohio

June 17-19—Cedar Rapids, Iowa (*Roosevelt Hotel*)
IOWA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., L. F. Skorczeski, 207 South 15th Ave., Marshalltown, Iowa.

June 18—Wentworth, N. H.
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, 73 Tremont St., Boston, Mass.

June 24-26—Minneapolis, Minn. (*Pick Nicollet Hotel*)
CENTRAL STATES SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Scott A. Linsley, P. O. Box 3598, Child Rd., St. Paul Minn.

July 12-17—San Francisco, Calif., (*Civic Auditorium*)
A.W.W.A. CONVENTION, Secy., Harry E. Jordan, A.W.W.A., 2 Park Ave., New York 16, N. Y.



AMERICAN CONCRETE CYLINDER PIPE *provides...*

DEPENDABILITY with ECONOMY

This pretensioned concrete cylinder pipe embodies all of the qualities and characteristics sought by water works engineers for permanent water supply and transmission lines—strength, sustained high carrying capacity; trouble free service and unusually long life. Its competitive initial cost has made it possible for hundreds of water works agencies throughout the West to obtain these desired qualities for pipelines with pressures generally ranging from 100 psi upward, and requiring diameters of 10" through 60" (or in many cases larger, where specific project conditions permit). When you select pressure pipe for your permanent water "growth lines," be sure to investigate American Concrete Cylinder Pipe, a superior product with an outstanding record of acceptance.

A. The steel cylinder provides a positive water seal or membrane as well as part of the total steel area required for internal stresses.

B. The smooth centrifugally applied mortar lining of at least ¾" thickness provides positive internal protection, sustained hydraulic capacity, and, imparts rigidity and strength through "arching effect."

C. Steel reinforcement rods, which together with the steel cylinder provide the total cross-sectional steel area required for the operating pressure specified, are wound under controlled tension and accurate spacing around the concrete lined cylinder, placing it under moderate compression.

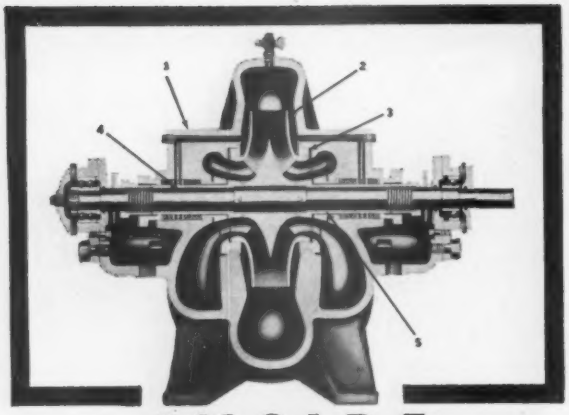
D. In conjunction with the steel rod reinforcement along the entire surface of the cylinder, the application of a dense concrete coating produces, in effect, a **reinforced jacket** which affords additional structural strength as well as positive exterior protection.

The 32-foot long pipe sections are easily installed with standard equipment using a single cable sling. In addition to providing a watertight seal, the rubber gasketed joint facilitates ease and economy of installation, and eliminates the need for caulking or field welding.

American PIPE AND CONSTRUCTION CO.

LOS ANGELES: 4635 Firestone Blvd., South Gate, Calif.—LOrain 4-2511
HAYWARD: P. O. Box 630 — JEfferson 7-2072
SAN DIEGO: P. O. Box 13 — CYpress 6-6166
PORTLAND: 518 N. E. Columbia Blvd.— BUtler 5-2531
ALBUQUERQUE: P. O. Box 1782 — CHapel 7-0486
PHOENIX: American Concrete Pipe Co. (Subsidiary)
P.O. Box 12127 — Alpine 2-7566

CONCRETE PIPE FOR MAIN WATER SUPPLY LINES. STORM AND SANITARY SEWERS. SUBAQUEOUS LINES



INSIDE
an outright cost-saver

Here's a clear picture of why you can depend on Weinman split case centrifugal pumps to cut liquid handling costs. And this holds true for circulating and pressure boosting service of hot or chilled liquids.

1. Horizontal split-casing opens easily for inspection; entire rotating element is removed without disturbing pipe connections or driver. You save maintenance time and costs.
2. Efficient 1-piece impeller. Machined exterior surfaces, hand finished interior surfaces to minimize friction losses. Result: More liquids handled with less power.
3. Hard bronze impeller wearing rings, fitted to extra close ring clearances. Efficient, last longer, easier to replace.
4. Machined, manganese-chrome alloy steel shaft. Delivers full power without deflection or vibration. This means less wear, longer service life, lower maintenance costs.
5. Sealed ball-bearing housings. Entire rotating element with bearing housings is removed and reinstalled simply. And, there's no chance of misalignment or exposing the bearings to water and dirt.

Complete information about money-saving Weinman split-case centrifugal pumps is included in Bulletins No. 1000, No. 1100, No. 1200 DS, No. 1200 SS. You can get your free copies by just asking us for them. Or, call your Weinman Pump Specialist. He's listed in the Yellow Pages.

Weinman horizontal split-case pumps are available with capacities to 4000 GPM.

THE WEINMAN PUMP MFG CO
290 SPRUCE ST. COLUMBUS 8, OHIO

CENTRIFUGAL SPECIALISTS

July 12-17—San Francisco, Calif., (*Civic Auditorium*)
CALIFORNIA SECTION, A.W.W.A., In Conjunction with National Convention, Secy., Roy E. Dodson, Jr., San Diego Water Dept., Balboa Park, San Diego 1, Calif.

July 22-25—Berkeley, Calif. (*Univ. of Calif.*)
FIRST INTERNATIONAL CONF. ON WASTE DISPOSAL IN MARINE ENVIRONMENT, Prof. Erman A. Pearson, San. Engr., Research Laboratory, Univ. of Calif., Berkeley 4, Calif.

Aug. 12-14—University Park, Pa. (*Pa. State University*)
PENNSYLVANIA SEWAGE & INDUSTRIAL WASTES ASSN., Secy., J. R. Harvey, 996 S. Main Street, Meadville, Pa.

Aug. 13—Vinal Haven, Maine
MAINE WATER UTILITIES ASSN., Secy., G. F. Laurin, 89 Western Ave., Augusta, Maine

Sept. 2-4—Huron, So. Dak. (*Marvin-Hughitt Hotel*)
SOUTH DAKOTA WATER & SEWAGE WORKS CONF., Secy., Don C. Kalda, Pierre, So. Dak.

Sept. 7-9—Jackson, Wyoming (*Jackson Lodge*)
ROCKY MOUNTAIN SEWAGE & INDUSTRIAL WASTES ASSN., Secy., Verne E. Plath, P. O. Box 149, Englewood, Colo.

Sept. 9-11—Milwaukee, Wis. (*Hotel Schroeder*)
WISCONSIN SECTION, A.W.W.A., Secy., Harry Breimeister, City Engrs. Office, City Hall, Milwaukee 2, Wis.

Sept. 9-11—Altanta, Ga. (*Ga. Inst. of Tech.*)
GEORGIA WATER & SEWAGE ASSN., Secy., A. T. Storey, 1210 Hemphill Ave., N. W., Atlanta, Ga.

Sept. 9-11—Liverpool, Nova Scotia, Can. (*White Point Beach Lodge*) CANADIAN SECTION, A.W.W.A., Maritime Branch, Secy., J. D. Kline, Public Service Commission, P.O. Box 608, Halifax, N. S.

Sept. 13-18—Atlantic City, N. J.
136TH NATIONAL MEETING AMERICAN CHEMICAL SOCIETY, Secy., H. B. Gustafson, P. O. Box 5033, Tucson, Ariz.

Sept. 14-16—Lexington, Ky. (*Lafayette Hotel*)
KENTUCKY-TENNESSEE SECTION, A.W.W.A., Secy., J. Wiley Finney, Jr., Howard K. Bell, Cons. Engrs., 553 South Limestone St., Lexington, Ky.
(Jointly With)
KENTUCKY-TENNESSEE INDUSTRIAL WASTES & SEWAGE WORKS ASSN., Secy., S. Leary Jones, Cordell Hull Bldg., Nashville, Tenn.

Sept. 16-18—Upper Saranac Lake, N. Y. (*Sarnac Inn*)
NEW YORK SECTION, A.W.W.A., Secy., Kimball Blanchard, 19 W. 50th Street, New York 20, N. Y.

Sept. 20-23—Lake Placid, N. Y. (*Lake Placid Club*)
NEW ENGLAND WATER WORKS ASSN., Secy., Joseph C. Knox, N.E.W.W.A., 73 Tremont St., Boston 8, Mass.

Sept. 23-25—Grand Forks, No. Dak. (*Dacotah Hotel*)
DAKOTA WATER & SEWAGE WORKS CONF., Secy., W. Van Heuvelen, c/o State Dept. of Health, Bismarck, N. Dak.

Sept. 23-25—Saginaw, Mich. (*Bancroft Hotel*)
MICHIGAN SECTION, A.W.W.A., Secy., T. L. Vander Velde, State Dept. of Health, DeWitt Road, Lansing 4, Mich.

BADGER'S COMPOUND WATER METER ASSURES FULL REVENUE FOR ALL WATER DELIVERED

Wherever water flow rates fluctuate considerably during the day — in schools, factories, hotels, theaters, apartment houses, dairies, laundries — Badger's compound meter assures economical, efficient service.

This compound meter combines Badger's disc and turbine meters to provide accurate registration at all rates of flow. You get the full revenue to which your water department is entitled for water actually delivered.

It is the industry's only compound meter where only one side operates at a time. A patented balanced compounding valve directs small streams through the disc meter, large streams through the turbine side... for accurate measurement of all rates of flow, less wear and longer service life.

Write for complete details now.

Badger Water Meters

BADGER METER MFG. CO. • 4545 W. Brown Deer Rd. • Milwaukee 18, Wisconsin • *Offices in principal cities*

News of Suppliers

WSWMA Members to Exhibit at San Francisco Meeting

101 members of the Water and Sewage Works Manufacturers Association, Inc., will exhibit at the AWWA Convention to be held in the Civic Auditorium and Brooks Hall, San Francisco, California, July 12-17, 1959:

Adams Pipe Repair Products
Allis-Chalmers Mfg. Company
Hydraulic Division
American Cast Iron Pipe Company
American City Magazine, The
American Pipe and Construction Co.
American Well Works, The
Armco Drainage & Metal
Products, Inc.
Badger Meter Mfg. Co.
B-I-F Industries, Inc.
Brooks Products, Inc.
Buffalo Meter Company, Inc.
Byron Jackson Pumps, Inc.
Calgon Company Division
Hagan Chemicals and Controls,
Inc.
Calmet Meter Division
Worthington Corporation
Centriline Corporation
Chain Belt Company
Chicago Bridge & Iron Company
Cla-Val Co.
Clow & Sons, Inc., James B.
Consolidated Western Steel Division
U.S. Steel Corp.
De Laval Steam Turbine Company
Dorr-Oliver Incorporated
Dresser Manufacturing Division
Dresser Industries, Inc.
Electro Rust-Proofing Corp.
Engineering News-Record
Fischer & Porter Company
Fisher Research Laboratory, Inc.
Ford Meter Box Company, Inc., The
Foster Eng. Div.—Hammel-Dahl
Foxboro Company, The
Gamon Meter Division
Worthington Corporation
General Filter Company
Glenfield & Kennedy, Inc.
Golden-Anderson Valve Specialty
Co.
Graver Tank & Mg. Co.
Div. Union Tank Car Company
Greenberg's Sons, M.
Hach Chemical Company
Hammarlund Manufacturing Co.,
Inc.
Fred W. Hanks
Harco Corporation
Cathodis Protection Division
Hays Manufacturing Company
Hellige, Inc.
Hersey Manufacturing Company
Homelite
A division of Textron, Inc.
Industrial Chemical Sales Division
West Virginia Pulp and Paper Co.
Inertol Co., Inc.
Infilco Incorporated
Johns-Manville
Jones Company, James
Kaiser Steel Corporation
Fabricating Division
Keasbey & Mattison Company
Kennedy Valve Mfg. Company, The
Koppers Company, Inc.
Tar Products Division
Layne & Bowler, Inc.
Leopold Company, Inc., F. B.
Link-Belt Company
Lock Joint Pipe Company
Ludlow Valve Manufacturing Co.,
Inc.
McWane Cast Iron Pipe Company
M & H Valve & Fittings Company
Minneapolis-Honeywell Regulator
Co.
Mueller Co.
National Water Main Cleaning Co.
Neptune Meter Company
Pacific States Cast Iron Pipe Co.
Pelton Division
Baldwin-Lima-Hamilton Corp.
Permutit Company, The
Philadelphia Gear Corporation
Pilot Manufacturing Company
Pipe Linings, Inc.
Pittsburgh-Des Moines Steel
Company
Pratt Co., Inc., Henry
Preload Company, Inc., The
Price Brothers Company
Public Works Magazine
Rich Mfg. Co. of California
Roberts Filter Manufacturing Co.
Rockwell Manufacturing Company
Ross Valve Manufacturing Co., Inc.
Scranton Publishing Company
Water & Sewage Works
Industrial Wastes
Sherman Products, Inc.
Simplex Valve & Meter Co.
Smith Mfg. Company, The A. P.
Smith-Blair, Inc.
Smith-Scott Co., Inc.
Southern Pipe Division
U. S. Industries, Inc.
Sparkler Manufacturing Co.
Sparkling Meter Company
Stuart Corporation
Trinity Valley Iron & Steel Company
Tyler Pipe & Foundry Co.
United Concrete Pipe Corporation
United States Pipe and Foundry Co.
Wachs Co., The E. H.
Walker Process Equipment, Inc.
Wallace & Tiernan Incorporated
Water Works Engineering
Western City Magazine
Wheeler, C. H. Co., Economy Pumps
Div.
Wilgus Manufacturing Company
Wood Company, R. D.

Process Engineers Promotes Pratt

Process Engineers, Inc., Div. of the Eimco Corporation, has announced the appointment of Jack W. Pratt as Eastern Sales Manager. A veteran of twelve years with the company, Mr. Pratt will supervise all sanitary equipment sales activities in the area East of Rockies from headquarters at the Eimco-Process Research and Development Center in Palatine, Illinois.

Mr. Pratt holds a B.S. in Civil Engineering from the University of California, 1939, and an M.S. in Sanitary Engineering from Harvard University, 1940. Prior to joining Process Engineers in 1946 as a Sales Engineer, he served four years with the Civil Engineer Corps, U.S. Navy, and two years with the Bureau of Sanitary Engineering, State of California.

A registered Civil Engineer, Mr. Pratt is a member of the American Soc. of Civil Engineers, American Water Works Association and Federation of Sewage and Industrial Wastes Associations, and is a diplomat of the American Academy of Sanitary Engineers.

CONTINUED ON PAGE 96A

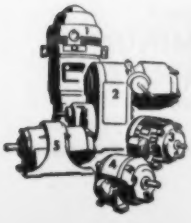
U.S. UNIBASE pump motor

...with exclusive MICROSET coupling

Designed to simplify pump maintenance and minimize down time in industrial short-coupled service, the new U.S. UNIBASE MOTORS make it easy to handle the replacement of pump seals and other recurring maintenance operations. Large side opening gives unhampered access to coupling. Ingenious coupling spacer arrangement eliminates necessity of dismounting motor to replace pump seal. Exclusive U.S. MICROSET COUPLING makes accurate fine adjustment of pump impellers quick and simple without coupling disassembly. Rigid, rugged UNIBASE is *one integral package*, factory tested for true alignment and concentric mounting... and delivered as a unit. UNIBASE MOTORS available in Type HV-1, dripproof, 7½ to 125 H.P.; Type JV-1, Totally-Enclosed; Type EV-1, Explosion-Proof. For short-coupled turbine pump applications, specify: "U.S. UNIBASE MOTORS."

FREE
COLOR BROCHURE

For Full Information, send for Unibase Bulletin No. F-1975



U.S. ELECTRICAL MOTORS INC.

P.O. BOX 2058
LOS ANGELES 54, CALIFORNIA
OR MILFORD, CONNECTICUT

U.S. MAJOR MOTOR LINES INCLUDE:
1. Vertical Solid & Holloshaft, 2. Varidrive, 3. Totally-Enclosed, 4. Uniclosed, 5. Syncrogear. Also, many other special motors.

News of Suppliers

CONTINUED FROM PAGE 94A

Fine Organics Moves

Fine Organics, Inc., are now located in the company's main plant at 205-252 Main St., Lodi, New Jersey.

In a statement announcing the move, Nicholas M. Molnar, President, said, "This move has been made for closer coordination between the Executive, Sales Research, Product Planning and Manufacturing Divisions of the Company. We feel confident that this consolidation in our modern, enlarged two and a third acre plant will result in greater efficiency and improved service to our customers. We will continue to avail ourselves of our manufacturing facilities in California, Kansas, and Texas."

Sperry Joins Weinman Pump

The Weinman Pump Manufacturing Co., Columbus, Ohio, has announced that J. M. Sperry has joined the sales department.

Prior to accepting his position with Weinman, Sperry, who is an experienced pump engineer, was in charge of the Washington, D. C. office of C. H. Wheeler Manufacturing Co., Economy Pump Div. Before moving to Washington he had been Assistant to the Vice-President, Sales of the Wheeler Company in Philadelphia.

Theodore D. Faulks Dies

Theodore D. Faulks, former sales representative and consultant of Neptune Meter Company, New York, died at his home in Newark, N. J.

Mr. Faulks had been an active and well known member of the water industry for many years. He joined Neptune Meter Company in 1903 as a sales engineer. Before retiring in 1934 he had worked in the midwest and on the eastern seaboard. He continued as a consultant for six years after his retirement from Neptune.

Prior to joining Neptune, Mr. Faulks was superintendent of the former West Orange, N. J. Water Co., and general manager of the Clinton Water Co. in Irvington, N. J. He was also associated with the construction of the sewer systems for East Orange, Orange, Somerville, Atlantic Highlands, and Summit, all in New Jersey.

Carlon Promotes Formato

Carlon Products Corporation, Aurora, Ohio has announced that Richard A. Formato has been appointed Sales Manager of the Southeastern Division.

Previously, Formato was a Carlon sales representative in Virginia, Maryland and District of Columbia. Replacing him in his former territory is Robert D. Pettit, Jr.

A native of Cleveland, Ohio, Formato attended Ohio University and was graduated from Western Reserve University. He has been with Carlon for 6 years, having served as sales promotion manager for two years before joining the firm's sales force. He will conduct his new duties at Carlon's Southeastern Division Sales Offices located at Asheville, North Carolina.

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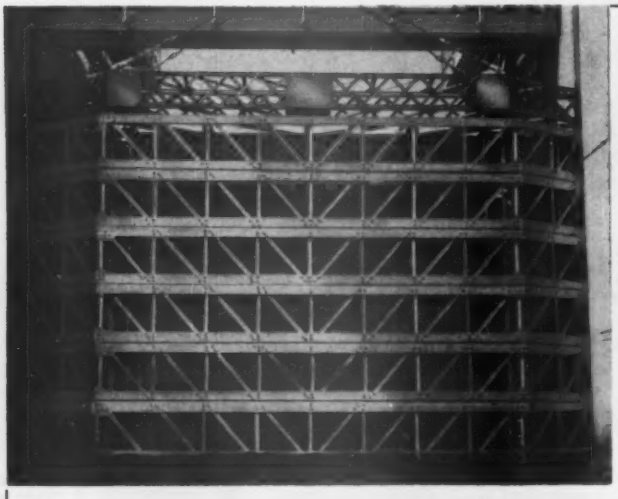


FROM BIG 38 FT. ALUMINUM FLOOD GATE TO SMALL STOP PLATE

No matter what your water and sewage equipment need . . . Washington Aluminum is your answer

Engineers who want to reduce installation costs and corrosion problems specify Washington Aluminum maintenance-free equipment. Washington Aluminum proven-in-use design and fabrication products makes this name a mark of distinction on every installation.

Among Washington Aluminum products are: Non-skid walkways, Sluice gates, Ladders, Aeration trays, Suspension bridges, Manhole covers—and all types of custom-fabricated products. If it should be aluminum . . . it should be made by Washington Aluminum.

WASHINGTON ALUMINUM COMPANY, INC., Dept. 76
BALTIMORE 29, MARYLAND

THE U. S. TREASURY SALUTES THE AUTO INDUSTRY

—and its thousands of employees who help strengthen America's Peace Power by buying U.S. Savings Bonds

The huge team that plans, builds and markets the cars America drives is making another great contribution to our national security. Thousands upon thousands of auto industry employees are buying U. S. Savings Bonds, regularly, through the Payroll Savings Plan.

Regular purchase of Shares in America helps these forward-looking people set up their own reserves for home building, for education and for greater security after retirement. The Payroll Savings Plan provides a sound, automatic way to practice thrift.

If your company has not yet put in a Payroll Savings Plan, start now. It's easy! Just telephone your State Savings Bond Director for the help he is eager to give you. Or write to Savings Bond Division, U. S. Treasury Department, Washington, D. C.

Henry V. Pogorzelski, pictured at work in one of America's great automobile plants, is typical of the thousands of skilled employees in this field who are buying U.S. Savings Bonds regularly. Mr. Pogorzelski uses his company Payroll Savings Plan to make his contribution to the Peace Power of his country.

WATER & SEWAGE WORKS

THE U. S. GOVERNMENT DOES NOT PAY FOR THIS ADVERTISEMENT. THE TREASURY DEPARTMENT THANKS, FOR THEIR PATRIOTISM, THE ADVERTISING COUNCIL AND THE DONOR ABOVE.

KNOW THE BENEFITS OF SILICA SOL FOR YOUR PLANT ?

Your plant may obtain benefits such as these through the use of N-Sol Activated Silica (coagulant aid).

- **improved quality of filter water**
- **wider effective pH range in treatment**
- **increased compaction of sludge**
- **increased equipment capacity**
- **reduced cost of new installation.**

N-Sol is prepared at your plant from N sodium silicate* and a reacting chemical.

Jar tests can help you decide. Ask for samples of N silicate and reactants for test.

*41° Baume (8.9% Na_2O, 28.7% SiO_2)

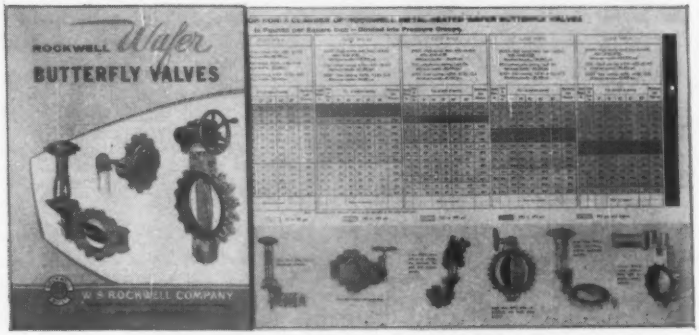
PQ SOLUBLE SILICATES

PHILADELPHIA QUARTZ CO.
1166 Public Ledger Bldg., Philadelphia 6, Pa.

Trademarks Reg. U.S. Pat. Off.

NOW! SELECTION MADE EASY

OF THE "WAFER" BUTTERFLY VALVE YOU NEED FOR REQUIRED RANGE OF PRESSURE DROP



This new Bulletin No. 583 gives all the facts to help you select just the size and construction of valve for your air, gas or liquid lines. Illustrations—charts—tables are arranged in a practical, easy-to-use manner. Write for your copy.

ROCKWELL SINCE 1888 BUILT

W. S. ROCKWELL COMPANY
Valves—Butterfly · Slide · Diaphragm · Special
2929 ELIOT STREET • FAIRFIELD CONN.

News of Suppliers

CONTINUED FROM PAGE 96A

Rockwell Promotes Gilbert & Sells

The Rockwell Manufacturing Company's Meter and Valve Division, Pittsburgh, Pa., has announced that Marc D. Gilbert has been named assistant to the mid-western regional manager. He was previously the division's Kansas City district manager.

Taking Mr. Gilbert's place in the Kansas City District Office is James H. Sells, San Francisco district sales manager for Rockwell's Municipal and Utility Division.

Mr. Gilbert joined Rockwell as a sales engineer in 1924. Before being promoted to his most recent position in 1952, he was district manager of the Tulsa District Office.

Mr. Sells joined Rockwell as a sales engineer. Before being promoted to his most recent position in 1956, he handled meter and valve sales in the Houston area and the New Orleans area.

Both men are members of the AWWA.

Reda Appointed Field Sales Mgr. For Hagan

Hagan Chemicals & Controls Inc., Pittsburgh, Pa., has announced the appointment of Herman A. Reda as field sales manager for the Industrial Chemicals Division.

He was formerly assistant district manager in charge of chemical sales in Chicago and will continue to operate out of that office while assisting district managers and agents in training new sales engineers. His duties also will include development of sales techniques and followups, and field evaluation of new products.

Mr. Reda is a past president of the Detroit Chapter of the National Association of Power Engineers, and currently secretary of the Industrial Water, Waste and Sewage group of the Chicago Engineers' Club.

STEEL PIPE IS RELIABLE AND RESILIENT

is your water supply safe from...

WASHOUT

SOIL MOVEMENT

SURFACE VIBRATION

WATER HAMMER

"wherever water flows...steel pipes it best!"

STEEL PLATE FABRICATORS ASSOCIATION

105 WEST MADISON STREET • CHICAGO 2, ILLINOIS

KOMLINE-SANDERSON PNEUMATIC SEWAGE EJECTOR SYSTEMS PROVIDE:

ASSURANCE—of carefully designed equipment, ruggedly constructed to give exceptionally long life and maintenance-free service.

ACCEPTANCE—of Komline-Sanderson Ejectors by more and more municipalities proves their worth

APPROVAL—of design application and components of ejectors by prominent consulting engineers insures your satisfaction.

WRITE FOR CATALOG NO. KSM-2

KOMLINE-SANDERSON ENGINEERING CORPORATION

102 Holland Avenue, Peapack, New Jersey

GUNITE does it 2 times as fast at 1/2 the cost

"Gunite" is the modern process (sand and cement applied pneumatically) for repairing, constructing, lining:

- Reservoirs
- Dams
- Filter Plants
- Sewage Disposal Plants
- Tanks
- Stadiums
- Bridges
- Sea Walls
- Swimming Pools, etc.

WRITE FOR MORE INFORMATION, INCLUDING 48 PAGE "GUNITE" BOOKLET.

PRESSURE Concrete Co.

FLORENCE, ALA. 1555 Helton Street

OTHER OFFICES IN

CHICAGO, ILL. 30 W. Washington Street

NEWARK 5, N. J. 193 Emmet Street

New Bulletins

AVAILABLE FREE

Air Compressors

621

Le Roi Div., Westinghouse Air Brake Co., Wis., has just published a 4-color, 12-page bulletin on the Westinghouse unit type air compressors.

The bulletin describes G single-stage, YS single-stage, and YC two-stage compressors ranging in size from ½ to 15 hp, at available pressures from 80 to 250 psi.

The bulletin uses halftones and cutaway photos to illustrate the three different models of compressors, which feature low oil level protection, enclosed crankcase, controlled pressure lubrication, and thermal overload protection.

Comprehensive specifications list CFM displacements, pressures, weights, dimensions, and RPM of the various models and sizes. A section of the bulletin is devoted to air receiver and auxiliary storage tank specifications and dimensions.

New Trademarks For Du Pont Weed Killers

622

E. I. Du Pont De Nemours & Co., Wilmington, Del., has announced that two new trademarks have been adopted for neburon and fenuron, members of the family of substituted urea herbicides, and changes in the use of the trademarks "Karmex" and "Telvar" for the compounds, diuron and monuron, have also been announced. The new trademark "Kloben" now identifies neburon weed killers (formerly known as "Karmex" N), and the trademark "Dybar" now applies to fenuron weed and brush killers. Fenuron weed and brush killer was formerly known as "Karmex" FP.

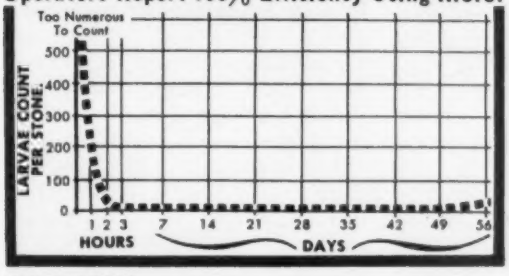
"Telvar" will now identify only products based on monuron and "Karmex" will identify only products based on diuron. Up to now the trademark "Karmex" has distinguished all agricultural herbicide formulations of the substituted urea her-

CONTINUED ON PAGE 102A

New • Proven

Ends Psychoda Problems In Trickling Filter Plants!

Operators Report 100% Efficiency Using R.S.C.



Test report 107-B

The Southwest Utilities Corp. in Houston, Texas, started the R.S.C. tests for Psychoda control on Sept. 9, 1958. Before treatment, Psychoda larvae under stones were too numerous to count. The premises were very heavily infested with adult Psychodae. Within *2 hours after treatment, no living larvae could be found in the bed.* All adults on the premises were killed on contact with R.S.C. spray. Daily checks were made for Larvae to a depth of two feet below the surface of the filter stones. Larvae did not reappear until Oct. 27, 1958. Adult Psychodae did not reappear until October 31, 1958.

R.S.C. is a scientifically compounded formulation designed to give long-lasting control and effective kill of ***PSYCHODA LARVAE, PUPAE*** and ***ADULTS.*** It is ***SIMPLE TO APPLY! SAFE TO USE!***

The ***R.S.C.*** emulsion in the primary tank will spread over the filter rocks through the rotary distributor arms and kill the filter fly pupae and larvae as it trickles down through the stones.

- **Will not harm the Zoogleal film on the filter stones essential to maximum filter efficiency.**
- **Will not adversely affect B.O.D. reduction.**
- **Will not kill snails.**

* PAT. APPLIED FOR

In test after test, all adult psychoda on walls and premises of trickling filter plants were killed *INSTANTLY* by spraying with a water emulsion of R.S.C.

DISTRIBUTORS WANTED

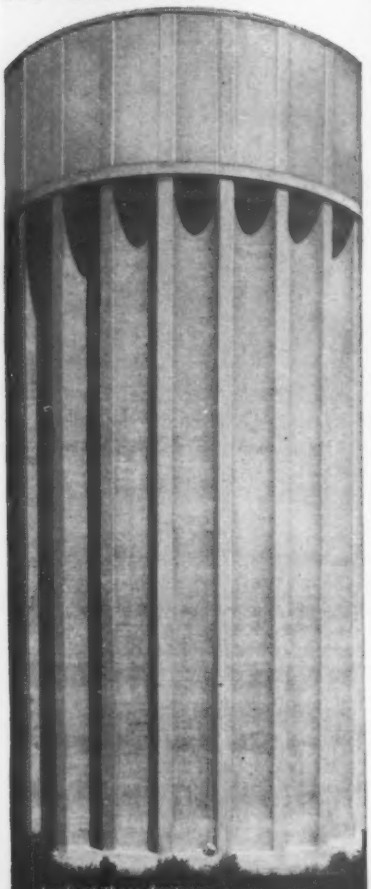
There are still a few openings for recognized distributors calling on sewage disposal plants. Send for complete information, data and price structure.

For full information, write, wire or phone UNion 5-3541

LEECO CHEMICAL CO. / Division of LEECO GAS and OIL CO.

800 71ST STREET • MIAMI BEACH, FLORIDA

MORE THAN 2000 PRESTRESSED CONCRETE TANKS IN SERVICE



Look at these features:
- No maintenance required
- 75% construction cost spent locally
- Lowest overall cost to community
- Owners never return to other types
- Longest service life of any tank

Send for Bulletin T-22

PRELOAD

THE PRELOAD COMPANY, INC.
211 East 37th St., New York 16, N. Y.
351 Jefferson, Dallas, Texas
711 Perimeter Road, Kansas City, Mo.
PRELOAD CONCRETE STRUCTURES INC.
837 Old Country Road
Westbury, Long Island, New York
HERRICK IRON WORKS
28400 Clawiter Road
Hayward, California
THE CANADA GUNITE COMPANY, LTD.
7325 Decarie Blvd.
Montreal 16, Canada

New Bulletins

CONTINUED FROM PAGE 100A

bicides. The trademark "Telvar" has been used to identify industrial formulations. Under the new nomenclature, all appropriate recommendations will be included on each label.

Continuous Wild Pipe

623

Jones & Laughlin Steel Corp., Pittsburgh, Pa., has available complete technical information and specifications on continuous weld pipe, in a new eight-page, four-color booklet.

Color photographs in the booklet portray the manufacturing process at J&L's two new continuous weld pipe mills, both of which went into production during the past year.

In addition, the bulletin contains a schematic drawing of the production of continuous weld pipe, which J&L markets under the trade name of Jal-Con-Weld.

Butterfly Valves

624

B-I-F Industries, Inc., Providence, R. I. has available a new two-color bulletin describing the extended line of Builders-Providence 125# class Butterfly Valves. The bulletin contains detailed information, cutaway drawings and photographs of the higher pressure butterfly valves, plus installation photos and information on choice of valve operators. Also included are, dimensional data and cross sectional drawings of the valves designed for line sizes ranging from 4" to 48".

According to the bulletin, these bubble tight butterfly valves are lightweight and compact, and can be supported by the line, eliminating special construction and burial without a vault. All valve sizes meet and surpass American Water Works Specifications for butterfly valves.

Diatomite Filtration

625

The Dicalite Dept., Mining & Mineral Products Div., Great Lakes Carbon Corp., Los Angeles, Calif., has available a 16 page bulletin on Diatomite Filtration of potable Water for Municipal Supply, Swimming Pools and Beverage Bottling.

The bulletin discusses in detail the basic characteristics of diatomite filtration, cost factors, efficiency of diatomite filtration, and operating factors of the filter system.

The bulletin is replete with photographs and drawings. Several typical installations of diatomite filtration for municipal water supply are also presented. A short bibliography on diatomite filtration completes the bulletin.

Fire Hydrants

626

Eddy Valve Co., Waterford, New York, has available a new folder on the improved, streamlined, modernized Eddy Fire Hydrants.

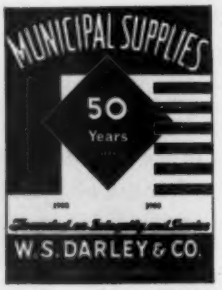
The folder describes the advantages and new innovations of the hydrant and cutaway keyed drawings illustrate the functions of the various parts of the hydrants. Installation photographs and a table of standard dimensions are also included.

Plastic Pipe

627

Southwestern Plastic Pipe Company, Mineral Wells, Texas, has available a 4-page, 2-color bulletin on Southwestern Plastic Pipe.

According to the bulletin, features of the pipe are: easy to handle and install; rust-proof, resists chemicals; unaffected by electrolytic corrosion; available in all sizes with ready-to-use fittings; easily coupled to other water lines; approved for underground



Write Today For 100 Page Catalog
W. S. DARLEY & CO. Chicago 12

sprinkler pressure and flood-type mains, and transmission of portable water.

The bulletin describes each type of installation in detail, and provides a form for ordering complete installation instructions and on-the-job assistance.

Stainless Steel Valves

628

Jenkins Bros., New York, N. Y., has just released a new catalog of the complete line of Jenkins Stainless Steel Gate, Globe and Swing Check Valves, No. 59 SS, and presents full details about valve patters in alloys that satisfy the requirements of most corrosive services. Adding to the usefulness of the new catalog is a 10 page section which shows at a glance the degree of resistance of the Jenkins alloys to many corrosive media under varying conditions.

Mixers and Mixing

629

Infilco Inc., Tuscon, Ariz. has announced the publication of a new bulletin on Mixers and Mixing. The bulletin discusses the theory of mixing and compares the range of operations of different types of mixing equipment.

The booklet also contains tables which assist the engineer in the selection of mixer size for any specific application, depending upon the degree of mixing required. The material is clearly divided into discussions of rapid mixing, slow mixing, i.e. blending and floucculating, and gas dispersing mechanical equipment.

Indicating Dial Thermometers

630

U.S. Gauge, Division of American Machine and Metals, Inc., Sellersville, Pa., has released a new 12-page Catalog 205 on "Dial Thermometers" that describes the company's completely redesigned line of indicating dial thermometers for temperature measurements in the range of —40°F to + 1000°F. The new line bears the tradename "Supertherm", being similar in both design and appearance with the company's premium-quality "Supergauge" line of pressure gauges.

Diaphragm Valves

631

Hills-McCanna Co., Chgo., Ill., has just released a new six page two-color bulletin on Diaphragm Valves For Every Type of Pipe, has just been released.

This bulletin contains many helpful items that should be considered when selecting valves for process piping systems. The advantages of diaphragm valves and their ability to meet pipe specifications is also covered. Typical process applications are also shown.

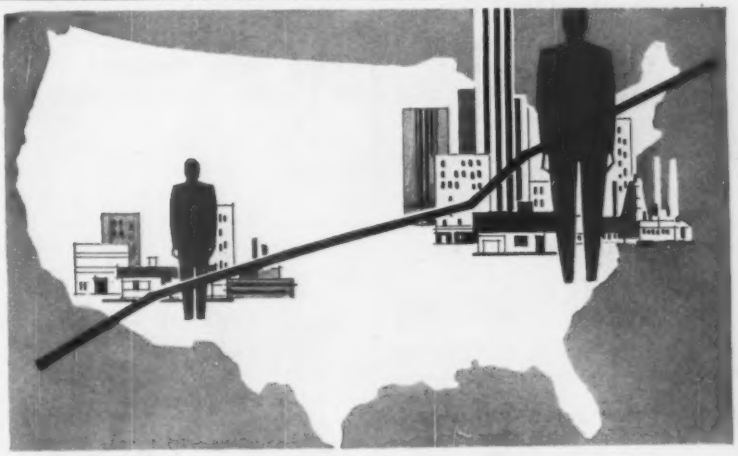
Clarifiers and Oxidators

632

Process Engineers, Inc., Div. of the Eimco Corp., San Mateo, Calif., has just published a 24 page brochure covering its line of Clarifier and Oxidator mechanisms for water, sewage and industrial waste treatment. In it are described the basic types that cover a full range of tank sizes and load requirements, and special units for unusual conditions.

The bulletin gives comprehensive information on vertical shaft, center column and traction information, as well as two design innovations pioneered by Eimco-Process: the large diameter feedwell clarifier and the

CONTINUED ON PAGE 104A

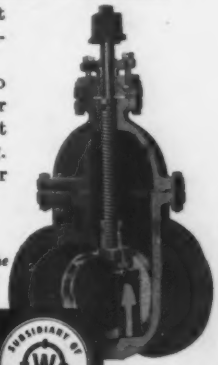


PEOPLE AND WATER

Two things mostly have brought about America's present water problem: Increasing population and progress of human civilization. Both are cumulative and therefore will surely produce greater water problems in the future.

Ancient Man simply knelt beside a stream and drank water like any other animal. But for one human who existed in the time of Moses, there now are millions. Today, the fastest growing population in the world is in America. It is estimated the U. S. population by 1975 will be 227 million. Present water consumption is 140 gallons per capita per day and steadily increasing. The Earth's total volume of water is abundant. Man's problem is to capture and purify enough of it at one time during the hydrologic cycle to serve his increasing needs due to the progress of civilization.

Water is the natural resource most essential to human survival, yet public support of modern water development and research has been lacking. Don't let your water works superintendent do all the worrying. He has big plans for the future. But, he needs your help and encouragement.



This Series is an attempt to put into words some appreciation of the water works men of the United States.

M&H VALVE
AND FITTINGS COMPANY
ANNISTON, ALABAMA

SUBSIDIARY OF W WALWORTH

New Item . . .
RTM ROTO-TROL
Multi-Circuit Pump Controller

- Recording and Indication when Desired
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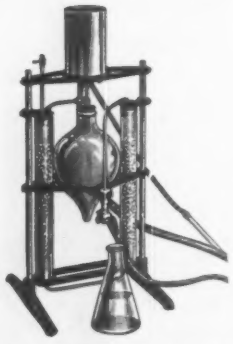
- Any Distance between Transmitter & Receiver

The RTM Roto-Trol operates on the time impulse principle. A tested and proved switching mechanism is operated by a powerful dual motor drive. The motor starters can be controlled direct from the heavy duty mercury switches.

Write for New Bulletin RTM

HEALY-RUFF Company
783 Hampden Ave., St. Paul 14, Minn.

ENSLOW
STABILITY INDICATOR



For checking the equilibrium of a finished water, and supplying an index useful in controlling anti-corrosion treatment. Catalog No. 83-895

WRITE:

Phipps & Bird, Inc.
P. O. Box 2V Richmond 5, Va.

New Bulletins

CONTINUED FROM PAGE 103A

anular trough Oxidator. Related and auxiliary equipment, such as sludge thickeners, the Clarifier-Digester, a Combined Sewage Treatment Plant, skimming devices and Non-Clog Diffusers, are also described.

The bulletin is printed in two colors and is profusely illustrated with drawings, diagrams and installation photos.

Plug Valve Actuator

633

Pantex Mfg. Corp., Pawtucket, R.I., has just released a new 22 page brochure which gives data on Pantex plug valve actuators. Included are specifications, dimensions and torque information; also revised and expanded selection tables.

Called the Plug Valve Actuator Blue Book, the new brochure is useful to plant design and construction engineers in selecting the correct-size Pantex actuator for plug valves (up to 12 inches) of leading manufacturers.

Side Suction Centrifugal Pumps

634

Goulds Pumps, Inc., Seneca, Falls, N. Y., has just released a bulletin describing its line of single stage side suction centrifugal pumps with open impeller.

Specifications, sectional view, dimensional chart, materials of construction and parts interchangeability charts, and performance curves are included in the bulletins. According to the bulletin, the pumps are built in three groups, and achieve a high degree of standardization and interchangeability of parts which results in economical initial cost and minimum inventory of spare parts as well as flexibility in making changes to meet new requirements.

Temperature Readout Accessory

635

Beckman/Scientific and Process Instruments Division, Fullerton, Calif., has available a specifications

switch to
Anthrafilt
Trade Mark Reg. U.S. Pat. off.
THE MODERN ALL-PURPOSE
FILTERING MEDIUM
Best for All Types of Filters

ANTHRAFILT
offers important advantages over sand and quarts

DOUBLES length of filter runs.
REQUIRES only half as much wash water.
KEEPS filters in service over longer periods.
INCREASES filter output with better quality effluent.
GIVES better support to synthetic resins.
PROVIDES better removal of fibrous materials, bacteria, micro-organic matter, taste, order, etc.
IDEAL for industrial acid and alkaline solutions.
EFFECTIVE filtration from entire bed.
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ROBERTS FILTER
MANUFACTURING CO.
•
DEPENDABLE MODERN
WATER PURIFICATION EQUIPMENT
CALL OR WRITE
MECHANICAL EQUIPMENT BY
ROBERTS FILTER MFG. CO.
DARBY, PENNA.

sheet describing a new accessory for recording gas chromatograph column or sample inlet temperature directly on the recorder chart.

The bulletin explains the use of the Temperature Readout Accessory, a temperature measuring-recording device for installation on one-millivolt recorders used with Beckman and other gas chromatographs.

Clarifier and Thickener

636

Infilco Inc., Tucson, Arizona, has just published a 16 page bulletin that describes three types of clarifiers and thickeners for handling liquid-solids separation in water, sewage and industrial wastes treatment, and includes many detailed variations in installations, both large and small. Three types of skimming mechanisms are offered, and typical low, medium, and high torque drives are illustrated.

Ductile Iron Products

637

American Cast Iron Pipe Co., Birmingham, Ala., has just published a 36-page illustrated catalog describing the complete line of American Ductile Iron products.

The catalog gives valuable technical information including grades, specifications, dimensions and weights, uses and applications.

American Ductile Iron products supplement an already complete line of products offered by American for many years and are available in sizes 2-48 in. diameters.

Manometers—Theory and Application

638

The Dynametrics Corporation, Northwest Industrial Park, Burlington, Mass., has just issued an 8-page brochure on Manometers—Theory and Application.

The principles and terminology encountered in manometry are explained. Different types of manometers are described and a number of manometer applications with working diagrams are presented. Useful conversion tables for different manometer fluids are also included.

Fluid Proportioning

B-I-F, Industries, Inc., Providence, R. I., has just published a new bulletin describing the use and application of the improved Model 1140 Proportioneers Adjust-O-Feeder designed for fluid proportioning over a wide range of capacities and pressures.

The black and white, 4-page bulletin features explanatory text, photographs, and cutaways showing the new fluid end construction and exclusive Vane Guide check valves. Also included is a detailed capacity chart with pressure ratings, and specifications and dimensions.

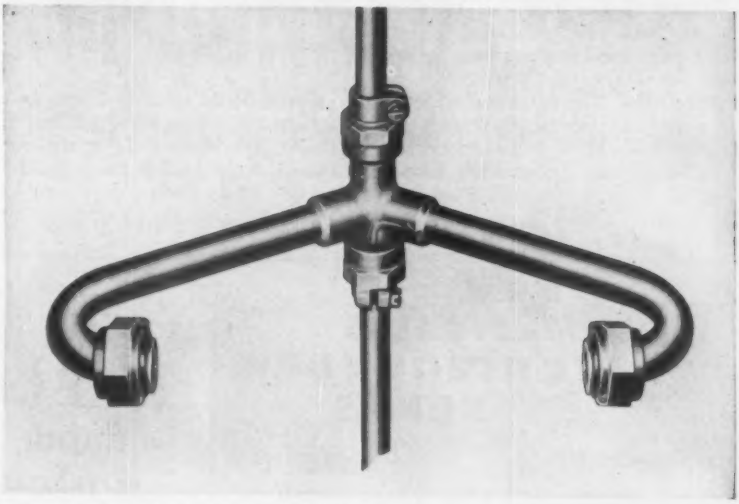
pH Measurement Techniques

639

Beckman Scientific and Process Instruments Div., Fullerton, Calif., has released a new data sheet that presents techniques for making accurate pH measurements in usually troublesome samples such as soils, emulsions, suspensions and oils.

Continued on page 106A

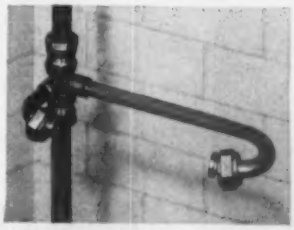
NO basement meter mounting can be installed as quickly and easily as Ford's "HANDYHORN"!



The new Ford HANDYHORN (above) eliminates pipe threading, flaring and soldering, puts meter right side up, and provides a permanent physical and electrical connection of the service even when the meter is removed.

Quickest and simplest means of setting meters in basements, the HANDYHORN can be installed with saw and wrench. It can be used in nearly all vertical piping. Tubes are set at an angle of 120° to permit installation in corners where pipe is at least 2″ from wall surfaces.

Convenient, durable and attractive, the HANDYHORN is the modern way to mount water meters . . . reduce installation costs.



Where piping is too close to corner . . . the Ford KORNERHORN can be employed. Like the HANDYHORN, this mount does not require flaring or soldering . . . and is quick and easy to install.

For more information, write . . .

FORD

FOR BETTER WATER SERVICES

THE FORD METER BOX COMPANY, INC. Wabash, Indiana

New Bulletins

CONTINUED FROM PAGE 105A

Submersible Pumps

640

Sumo Pumps Inc., Stamford, Conn., has just published a 4-page bulletin describing a wider range of 4-inch submersible pumps featuring new ratings and new performances.

Shaft-Mounted Speed Reducer

641

Link-Belt Company, Chicago, Ill., has issued a new 24 page book describing its completely new line of shaft-mounted speed reducers.

Well Screen Pipe

642

Emsco Screen Pipe Co., Houston, Texas, has just published a new eight page catalog describing Screen Pipe for oil, gas and water wells, including the "More Area" Slotted Screen Pipe, Vertical Slotted and Drilled Hole Wire Wrapped Screen, and Pre-packed Gravel Pack Screen, together with specifications of various types.

Water Requirements For Nuclear Plants

643

Graver Water Conditioning Co., New York, N. Y., has available a reprint of the article, "Ultra Pure Water—Prime Requisite for Nuclear Power Plant Cycles."

Controlled Volume Pumps

644

Milton Roy Co., Philadelphia, Pa., has just published a Bulletin describing the new line of Milroyal controlled volume pumps with totally enclosed drives. This bulletin describes the design features of the pumps and tell how they work as well as providing specifications.

Gratings Manual

645

Klemp Metal Grating Corporation, Chicago, Ill., has just published a new 20-page "Data and Specification" Manual designed for the permanent libraries of architects, engineers and plant supervisors.

Large Diameter Clay Pipe

646

Robinson Clay Products Co., Akron, Ohio, has just published an illustrated 4 page folder that describes the complete line of large diameter clay pipe and fittings.

Tunnel Liner Plates

647

Commercial Shearing & Stamping Company, Youngstown, Ohio, has available a new 20-page publication that covers steel tunnel liner plates.

Sea Water Evaporators

648

The Maxim Silencer Co. Subsidiary, Emhart Mfg. Co., Hartford, Conn., has available a plastic-bound, profusely-illustrated, 24-page booklet, entitled "Fresh Water Unlimited."

Slide Selector For Liquid Level Gages and Valves

649

Jerguson Gage & Valve Co., Burlington, Mass., has announced a new Slide Selector for easy selection of the correct size and type of liquid level gages and valves for any job.

AUTOMATICALLY CONTROL YOUR PUMPS

Preset

- LENGTH OF TIME
- TIME OF DAY OR NIGHT
- DAYS OF THE WEEK
- ON OR OFF HOURS
- SKIP DAYS

Synchro-Start AUTOMATICALLY will start and stop your pumping engine during any periods you require.

This control uses no commercial current as it operates from the engine's battery. The cabinet is double weather-proof and has knockouts for conduit wiring.

Write for Detailed Information

Please include all pertinent data regarding the installation and the engine you wish equipped.

SYNCHRO-START PRODUCTS, INC.

Since 1932

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APCO Super De Lavaud

In sizes 3" to 24" in modern long lengths. Bell and spigot, roll-on-joint and mechanical joint.

For water, gas and sewage.

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950 Dirks Building, Kansas City, Mo.
18505 W. Eight Mile Rd., Detroit 41, Mich.
5335 Southern Ave., South Gate, Calif.

Oster Pipe Machine Film

650

The Oster Mfg. Co., Wickliffe, Ohio, has just released a new 16 mm full color, sound film entitled "Breaking the Price Barrier."

The film features Oster's new, low cost "100" Power Drive and highlights the time, cost and work-saving advantages from its use—bith in the shop and on the job. Anyone having anything to do with threading of pipe or conduit will find this movie both interesting and informative.

C. B. & I. Services Booklet

651

Chicago Bridge & Iron Co., Chicago, Ill., has available a 4-page booklet entitled, "Creative Craftsmanship in Steel." The booklet describes the coordination engineering, fabrication and erection services offered by the company.

Control Valves

652

Conoflow Corp., Philadelphia, Pa., has just issued a new bulletin describing the company's complete line of Series LB Control Valves.

Low Pressure Compressors

653

Joy Manufacturing Co., Pittsburgh, Pa., has just published a new eight page bulletin covering the company's complete line of heavy duty, low pressure compressors.

F&P "Quick Shipment" Catalog & Price List

654

Fischer & Porter Co., Hatboro, Pa., has just published a 52 page catalog on process instruments available for quick shipment.

Spectrophotometer

655

Beckman/Scientific and Process Instruments Div., Fullerton, Calif., has available a new six page brochure, Accessories for the Beckman Model B Spectrophotometer.

Butterfly Valves For Altitude Tank Control

656

B-I-F Industries, Inc., Providence, R. I., has published a new bulletin describing the use of a Builders-Providence Butterfly Valve with a B-I-F Altitude Valve Controller for making an efficient, low cost altitude valve.

Plating Waste Treatment

657

Graver Water Conditioning Co., New York, N. Y., has available a paper on Variations in the Design of Plating Waste Treat Systems.

This article, discusses the various systems and methods, both batch and continuous, which may be used in the treatment of hexavalent chromium, cyanides, acids and alkalis.

Submersible Pump Motor

658

General Electric Co., Schenectady, N. Y., has just released a bulletin on their new Submersible Motor. The six page bulletin describes design and performance features of this first oil-filled motor ever marketed as a complete unit for four-inch well applications.

In-Line pH Control

659

Beckman Scientific and Process Instruments Div., Fullerton, Calif., has

CONTINUED ON PAGE 108A

McDONALD FOR OVER 100 YEARS

THE QUALITY NAME IN WATER WORKS BRASS GOODS

CORPORATION STOPS

4701 — With Straight Coupling Nut. (No Gasket).
Inlet: A.W.W.A. Corporation Stop Thread.
Outlet: Standard A.W.W.A. Thread for Copper Service Pipe.
Sizes: ½", ⅝" x ¾", ¾", 1", 1¼", 1½", 2".

4701

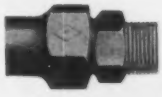
CURB STOPS – ROUND WAY – INVERTED KEY – COMBINED CAP AND TEE – WITH CHECK

4713

4713 — Stop
4714 — Stop and Drain. (Not Illustrated).
Inlet: A.W.W.A. Thread for Flared Copper Tube.
Outlet: A.W.W.A. Thread for Flared Copper Tube.
Sizes: ½", ¾", 1", 1¼", 1½", 2".

COPPER SERVICE PIPE FITTINGS

4753 — Straight Coupling.
Copper to Outside Iron Pipe Thread.
Sizes: ½", ½" x ¾", ¾", 1", 1¼", 1½", 2".


4753

4754 — Straight Coupling.
Copper to Inside Iron Pipe Thread.
Sizes: ½", ¾", 1", 1¼", 1½", 2".

4754

For information on McDonald's complete line of quality Water Works Brass goods, write to:

A. Y. McDONALD MFG. CO.
12th & Pine Sts. Dubuque, Iowa

RARE OPPORTUNITY FOR BUSINESS AND PROFESSIONAL DEVELOPMENT
For Engineers With Experience and Capability

To Serve in Connection With Product Development and Sales Engineering Promotion and Guidance of a National Technical Sales Organization

These positions involve high-calibre product management and field promotional engineering work, as part of this Company's decentralization program and long-range plans for expansion in related equipment and process fields, inclusive of Industrial Wastes. All applications should contain full information on professional and business training and experience which would fit the applicant for a position of unusual challenge and promise. Also indicate range of initial compensation desired. Interviews will be arranged. All information will be held in strictest confidence. Address replies to:

MILTON SPIEGEL,
Vice Pres. & General Mgr.
Chicago Pump Company
622 Diversey Parkway
Chicago 14, Illinois

WANTED

Sanitary Engineer to direct Division of Sanitation with generalized program in well established County Health Department. Population: 82,000. Liberal vacation, sick leave, retirement, longevity benefits. Cattaraugus County Health Department, 302 Laurens Street, Olean, New York. Salary: $6,564-$7,620.

WANTED—Experienced and competent engineers for design or/and supervision of construction of water works, sewerage, water treatment and sewage treatment plants. Permanent position. State age, experience, education, salary required.

Box 6000—Water & Sewage Works
185 N. Wabash Ave.
Chicago 1, Illinois

WANTED

Sanitary Engineer for department head of established firm in Midwest. Prefer age between 35 and 55. Applicant should have had responsibility of design of sewage and water treatment plant. Salary five figures with fringe benefits. Answer box 6010—Water & Sewage Works, 185 N. Wabash Ave., Chicago 1, Illinois.

WANTED

Experienced administrator with Municipal or Public Works background as General Manager of a water district in Pacifica, California; personnel experience required, public relations knowledge, some knowledge, of public bond procedures. Must be familiar with water works supply and purchasing practices, class II FCC Radio communications license desirable. State salary expected. All replies confidential, address to North Coast County Water District, Personnel Committee, Box 35, Pacifica, Calif.

POSITION WANTED

Sewage Plant Operator or Sup't, Activated sludge, trickling filter or any type. Abundance of experience, familar many types of equipment. Can take charge, make tests, supervise or operate. Construction and operation experience also in water purification plants as well as sewage plants. Prefer midwest area. Over 25 yrs experience. Salary secondary. Box 6020—Water & Sewage Works, 185 N. Wabash Ave., Chicago 1, Ill.

Advertise in the 1959 WATER & SEWAGE WORKS Reference Number

Sales Representatives

Large and well established company is building an ultra modern cast iron pressure pipe foundry at Council Bluffs, Iowa scheduled to go into production March 1960. Will require salesmen for various offices to cover: Colorado, Dakotas, eastern Illinois, Iowa, Kansas, Minnesota, Missouri, Nebraska, Wisconsin. Applicants must be known in the Water Works Field. Previous sales experience desirable. Salary open and commensurate with experience, bonus plan and liberal fringe benefits.

Unusual opportunity to get in on the bottom floor of a new organization. All inquiries will be treated as confidential. Send resume to:

Mr. Frank Marold, Vice President-Sales
Griffin Pipe Division
445 North Sacramento Blvd.
Chicago 12, Illinois

New Bulletins

CONTINUED FROM PAGE 107A

released an Application Data Sheet on In Line pH Control for Continuously Pressurized Processes.

Demineralization Handbook

660

Cochrane Corp., Philadelphia, Pa., offers a new, comprehensive forty-page book titled, "Handbook on Demineralizing." This handbook compares various methods of water treatment, as well as indicating the comparison between demineralizers and evaporators.

Water Equivalents and Data Card

661

Industrial Chemicals, Inc., South Bend, Indiana, has available a wallet-size plastic card containing data including water equivalents and estimated water requirements for steam generation, refrigeration and cooling.

Plastic Waste Disposal Product

662

The Dow Chemical Co., Midland, Mich., has completed a 32 page bulletin about Dowpac, the company's new plastic packing material used in the biological oxidation of liquid wastes.

Hydrographic Data Book

663

Leupold & Stevens Instruments, Inc., Portland, Ore., has announced the sixth edition of their Hydrographic Data Book.

The Data Book has been prepared and edited by J. C. Stevens, Dr. Eng., and is available direct from Leupold & Stevens Instruments Inc., for $1.00 per copy.

Wemco Pump Engineering Data

664

Wemco, Div. Western Machinery Co., San Francisco, Calif., has just published a bulletin containing engineering data for all models of the Wemco Torque-Flow pump.

Consulting Engineers *IN WATER & SEWAGE WORKS*

ALBRIGHT & FRIEL INC.
Consulting Engineers
Water, Sewage, Industrial Wastes and Incineration Problems—City Planning, Highways, Bridges and Airports—Dams, Flood Control, Industrial Buildings—Investigations, Reports, Appraisals and Rates—Laboratory for Chemical & Bacteriological Analyses—Complete Service on Design and Supervision of Construction.
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Philadelphia 2, Pa.

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Water and Sewage Works—Industrial Wastes—Refuse Disposal—Municipal Projects—Industrial Buildings—Reports—Plans—Specifications—Supervision of Construction and Operation—Valuations—Laboratory Service
75 West Street New York 6, New York

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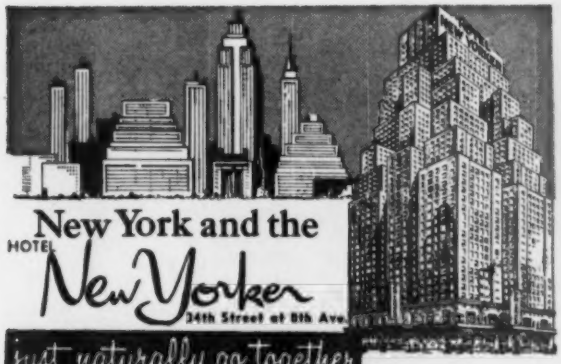

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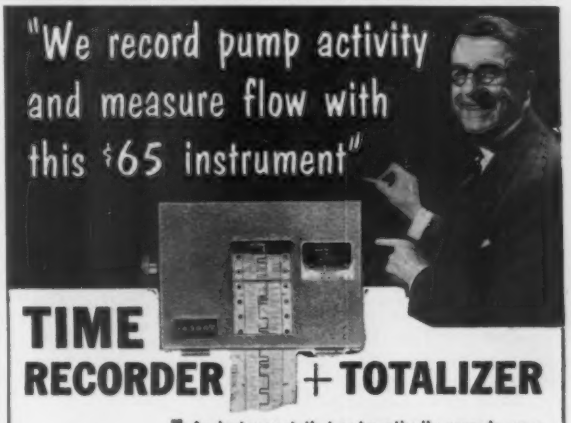

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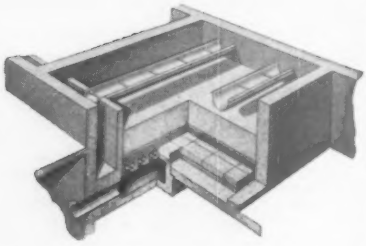

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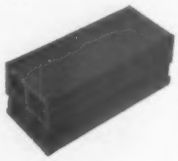

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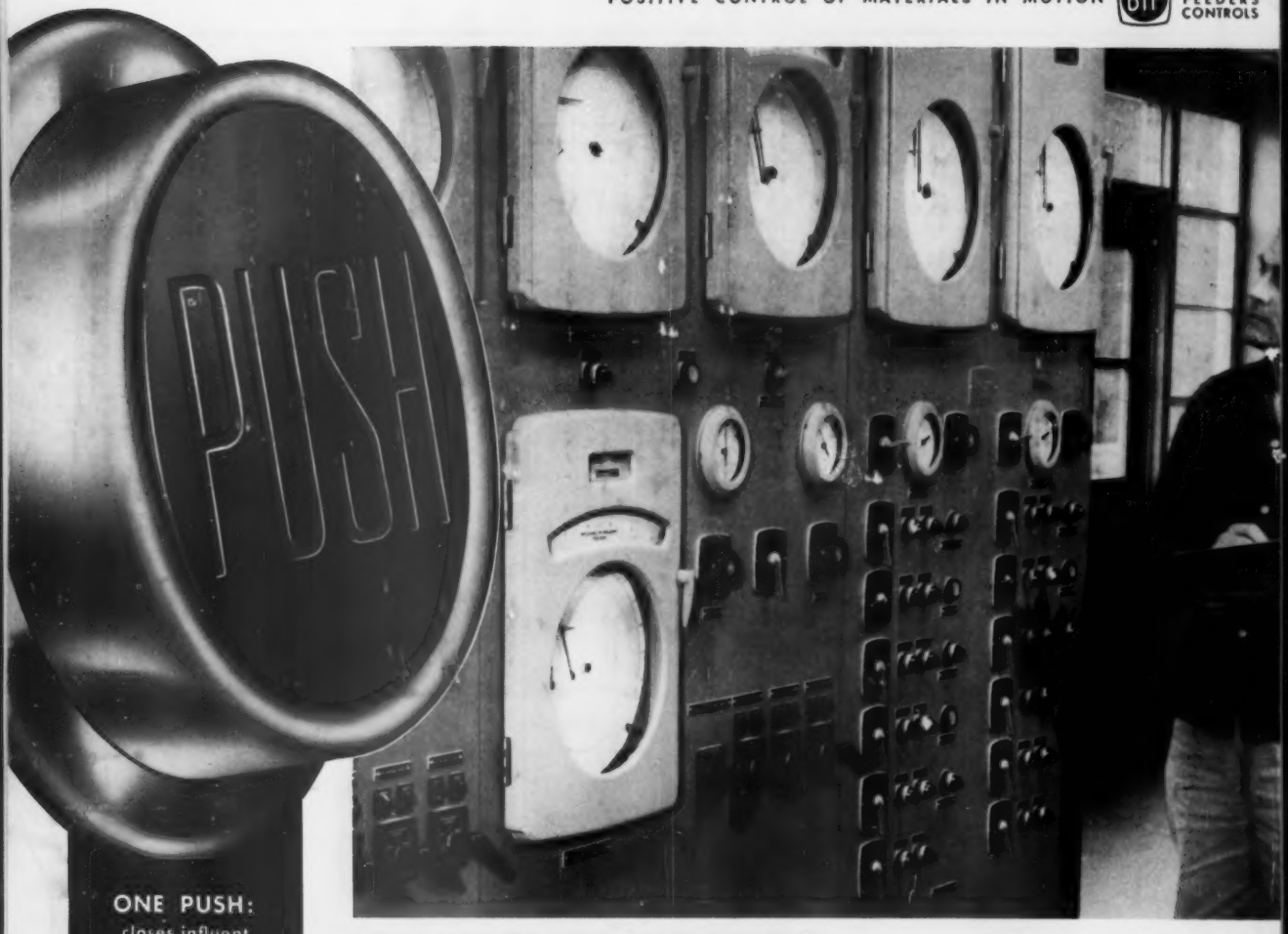

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